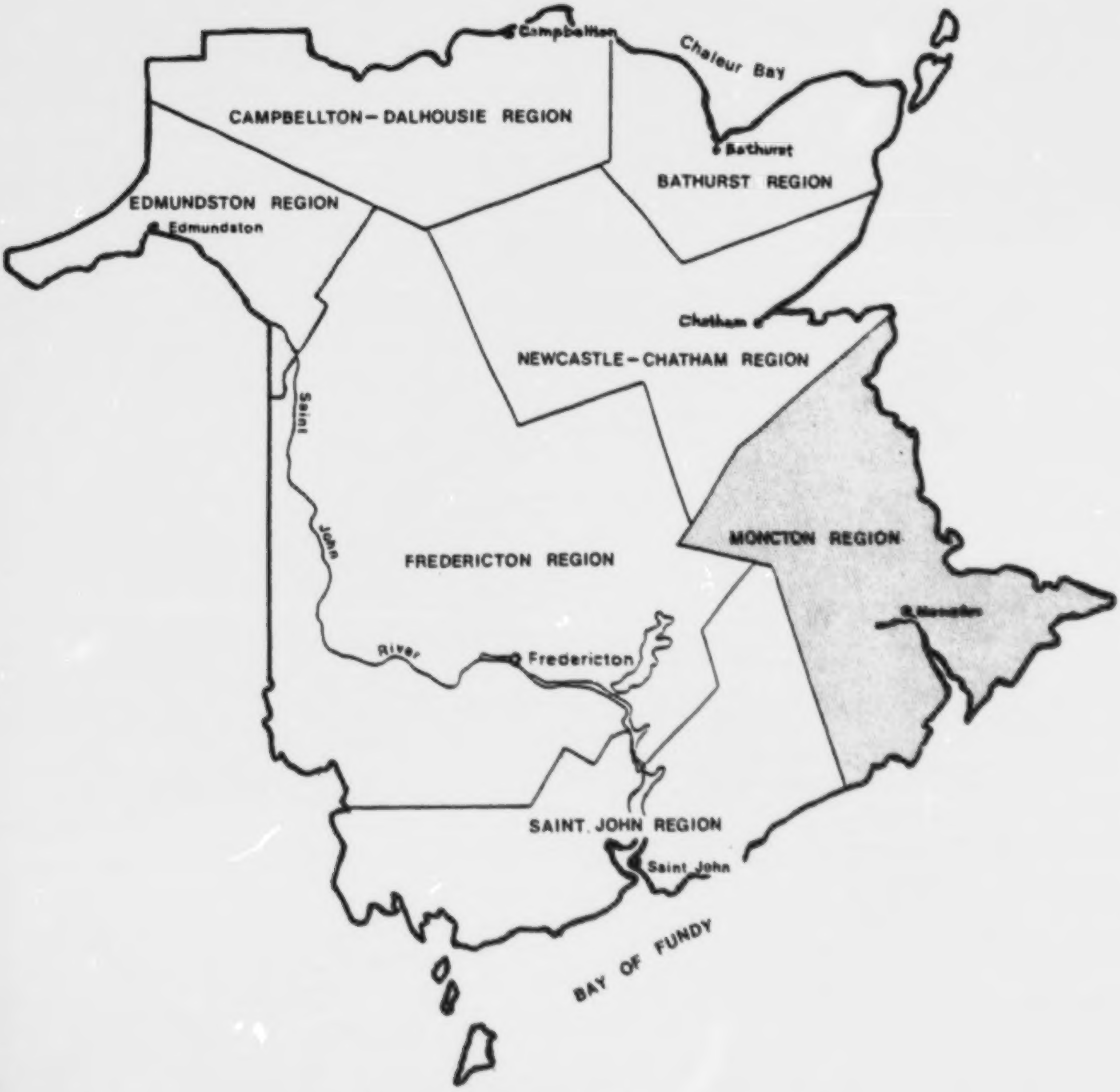
NEW BRUNSWICK
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

REPORT I-8402

MONCTON PLANNING REGION WATER RESOURCES REVIEW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DECEMBER, 1984

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WATER RESOURCES REVIEW

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W. Franklin G. Cardy, Director

NEW BRUNSWICK DEPARTMENT OF THE ENVIRONMENT

Hon. C.W. Harmer, Minister, B.B. Barnes, Deputy Minister

PREFACE

This is the seventh, and last, in a series of seven water resources review reports covering the entire Province of New Brunswick. These reports summarize the state of knowledge concerning the available water resources in each of the seven planning regions. They also identify existing and predicted constraints on the exploitation of the water resource and outline planning and management measures that may be taken to ensure continued resource availability for future use.

This report is devoted to the Moncton Planning Region which is located in southeastern New Brunswick and includes the Counties of Kent, Westmorland and Albert.

The contents of the report are presented as follows:

Chapter One provides a general introduction to the planning region with regard to its history, climate, and physiographic and geologic conditions.

Chapter Two deals with the water resources of the region. The planning region is divided into six different sub-areas and the water availability and use in each of these sub-areas is discussed.

Chapter Three covers specific water requirements and supplies for each of the nineteen incorporated municipalities within the planning region. Resource data are presented in a summarized format for use as a ready reference by those requiring information on the water resources of the region.

Factors related to the management of the water resource are discussed in Chapter Four. This chapter emphasizes the need for careful operation, maintenance, and protection of the public water supplies.

The Appendices provide specific information on the Moncton Planning Region. This information includes lists of hydrometric and water quality stations in the region as well as flow duration and low-flow analysis of the available historical data. A physical description of watercourses in the region is also presented here.

SUMMARY

This review of the water resources in the Moncton Planning Region highlights the fact that although most of the municipalities are situated along the main rivers and their tributaries, the smaller municipalities within the region, depend on groundwater for their water supply. Approximately two thirds of the region's population is concentrated in the City of Moncton and the Towns of Dieppe and Riverview where the Turtle Creek Watershed is used as the water supply for these municipalities.

In view of the above, it appears that the protection of surface water supply watershed is a major concern. Development within such watershed should be very carefully considered in order to maintain the water quality.

The other concern is to ensure that the water systems are operated with care and their performance monitored. Monitoring the pumping levels in production wells and performing leakage testing in the water supply systems are important for evaluating the performance of these systems.

The water quality in the Moncton Planning Region is generally good. However local groundwater quality problems exist in the heavily populated areas of several municipalities in the region. Therefore, considerations should be given to the development of public water supplies in these municipalities in order to ensure a good quality water.

RECOMMENDATIONS

The following recommendations have resulted from this review of the water resources in the Moncton Planning Region.

1. A groundwater monitoring program should be established in order to overcome the lack of information on the groundwater sources. Such a program would provide information which is necessary for the management and planning of the resource. It would also provide for identification and evaluation of potential aquifers. The data obtained from such a program is essential in evaluating the security of the groundwater resources from the quantity and quality points of view.

2. Periodic reviews of demand projections in relation to the available water resources should be made. Such reviews are essential tools for planning purposes. The time frame of these reviews would depend on the residential and/or industrial developments in each individual incorporated area.

3. All municipalities should keep daily records of their pumping rate as well as water level measurements in the production wells. Such records are necessary in evaluating the performance of the source and also in assessing the consumption rate within each municipality.

4. Development in areas surrounding groundwater sources, production wells and groundwater recharge areas should be planned so that the danger of spills of petroleum products or repeated unintentional applications of waste products or chemicals is limited as much as possible.

5. Development in watersheds and recharge areas used for public water supply sources should be very carefully considered to ensure that the quality of the sources is maintained. In the long run, development of the land must be carried out with the water resource in mind. Conversely, management of the water resources alone is ineffective without appropriate use of the land resource.

6. Municipalities should encourage their water works operators to attend training courses offered in their field. Such courses are designed, among other things, to familiarize the operators with the importance of thorough monitoring of their water supply systems.

7. A sediment monitoring network, for evaluating sediment loads into natural streams, should be established within the planning region. The need for such a sediment monitoring network is particularly important for evaluating various land use development within water supply watersheds such as the Turtle Creek.

8. Early communication and consultation should be established between municipalities or industries seeking new water supplies and the Water Resources Branch. Reference should be made to "The Guidelines for Approval of Water Supply Sources" available from the Water Resources Branch, New Brunswick Department of the Environment. Such an approach will result in better management of the resource and help to ensure the maintenance of adequate quantity and quality of water for all users within the region.

ACKNOWLEDGEMENTS

This report was prepared by the Water Resources Branch, New Brunswick Department of the Environment, under the direction of Mr. Franklin Cardy, The text was written by M.E. Folster and edited by Dr. Nabil Elhadi.

We also wish to thank those other agencies, municipalities and individuals who provided information for this report and who assisted in various ways with the preparation. Prominent among these were the Mayors of all incorporated municipalities within the Moncton Planning Region, the Pollution Control and Environmental Services Branches of the Department of the Environment as well as the Deputy Minister, Mr. Brian Barnes and the staff of the Water Resources Branch, especially Mrs. Denice Poirier who typed the report.

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CHAPTER ONE

THE REGION

1.1 Introduction

The Moncton Planning Region, shown on Figure (1.1), covers an area of approximately 10,230 sq. km. The majority of the incorporated municipalities in the planning region are situated along the main highways which generally follow river courses and along the coastal areas near fishing harbours.

The City of Moncton is the largest centre of population within the planning region. It serves as the commercial, industrial services and transportation centre for the region. The city has also become a major distribution centre for the Atlantic coast because of its geographical location and intensive transportation linkage. Therefore, the major industrial establishments are located within or in the vicinity of the City of Moncton.

Commercial fish processing plants characterize the Moncton Planning Region and are mainly located on the eastern coastal boundary of the region.

Recreational water use plays a significant role in the tourism industry within the region. This is due to the fact that the Fundy and the Kouchibouguac National Parks are located within the Moncton Planning Region as well as the availability of numerous beaches on the east coast.

1.2 History

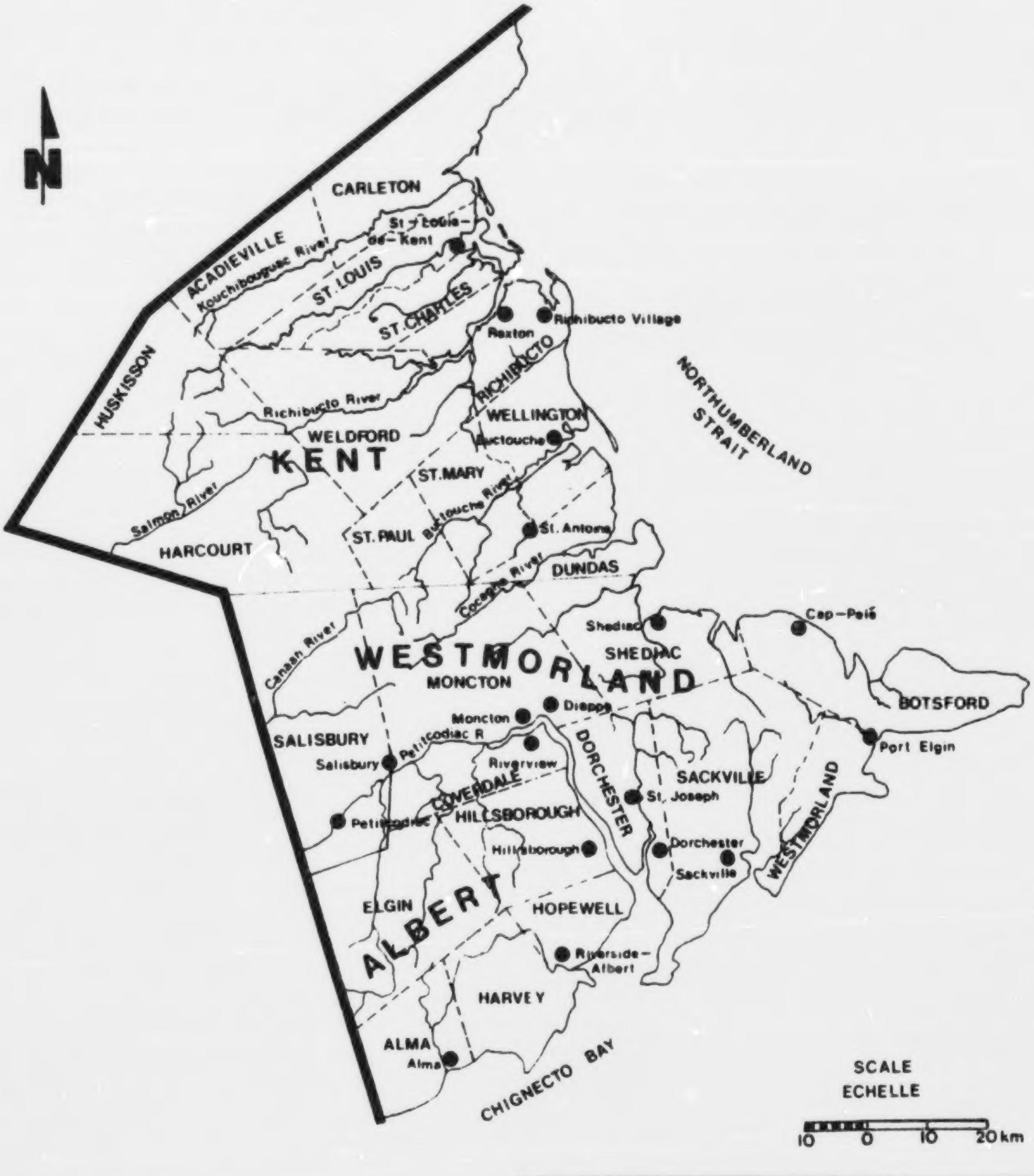
Knowledge of the historical development of a particular region is generally helpful in understanding its present condition. Each settlement plays its own role in the social and economic development of the region, and each makes its own special demands on the water resources. The history of the Moncton Planning Region is outlined in the following sections.

1.2.1 Pre-confederation Period

The oldest maps of North America show a vast expanse of sparsely populated land called "Cadie", "Accadie", or "Acadie" which stretched from the Atlantic and the Gulf of St. Lawrence between Cape Breton to Philadelphia. The first European who visited the eastern shores of this land found it to be unproductive, inhospitable terrain. But the vast forests of the eastern woodlands and the shores of drowned river valleys with the rich tidal ponds, lagoons and estuaries provided an abundance of raw materials, fish, birds and shell fish for the Micmac people. These earliest inhabitants were an Indian nation of tribes who spoke a common Algonquin tongue and lived a nomadic lifestyle ranging from the southern bank of the St. Lawrence to the New England States.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU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RICHIBUCTO
NORTHUMBERLAND STRAIT
Richibucto River
WELLINGTON
WELDFORD
Buctouche
KENT
ST. MARY
Salmon River
Buctouche River
St. Antoine
ST. PAUL
HARCOURT
DUNDAS
Cocagne River
Cap-Pelé
Shediac
Canaan River
SHEDIAC
WESTMORLAND
MONCTON
BOTSFORD
Dieppe
Moncton
SALISBURY
Petitcodiac R
Port Elgin
DORCHESTER
Riverview
Salisbury
SACKVILLE
COVERDALE
St. Joseph
Petitcodiac
HILLSBOROUGH
Hillsborough
Dorchester
Sackville
WESTMORLAND
ELGIN
ALBERT
HOPEWELL
Riverside-Albert
HARVEY
ALMA
Alma
CHIGNECTO BAY
SCALE
ECHELLE
10
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10
20 km

LEGEND
LÉGENDE

━━ REGION BOUNDARY
LIMITES DE LA RÉGION
- - - - PARISH BOUNDARY
LIMITS DE LA PAROISSE
── COUNTY BOUNDARY
LIMITES DES COMTÉS

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

PARISHES
LES PAROISSES

FIG. 1.1

Numerous waterways flowed east-west as well as north-south and provided transportation links which enabled the Micmac hunting range to extend between the Northumberland Strait and the Saint John River in New Brunswick.

Britons and Celts came mainly to fish and dry their catch at various sites along the eastern shoreline. The Spanish who came to "Nova Fransecata" found the climate inhospitable and did not settle. Jacques Cartier sailed the Northumberland Strait in 1534 but it was not until 1605 when Sammuel de Champlain established his colony at Port Royal that any permanent settlement was established. In 1646, the Jesuits established their first mission in Richibucto.

Colonization by west Europeans along the Northumberland Coastal region of New Brunswick began in the 17th century. The estuaries of the Northumberland coast were settled by both France and England. The population consisted mainly of French fishermen (Acadiens) and a few Irishmen and Scots. During the 17th and 18th centuries, these Acadians became pawns in a royal game of cession from the King of England to the King of France. This series of administrative changes included the following events:

- Acadia captured from the French by English from Virginia in 1613.
- Returned to France in 1632 by Treaty of St. Germain-en-Faye.
- Returned to England in 1654.
- Returned to France under Louis XIV - Treaty of Buda in 1667.
- In 1713 returned to English under Treaty of Utrecht.
- 1748 Acadia returned to France by Treaty of Aix-la-Chapelle.
- With British capture of Fort Beausejour 1755 - Acadian expulsion.
- Peace 1763, Treaty of Paris ending Seven Years War between France and Britain.

When the Seven Years War ended, Britain placed emphasis on colonization. After 1764, Acadians, who had been displaced from their homesteads in New Brunswick in 1755, together with Acadians from Nova Scotia and the Bay of Fundy area, began to return and re-establish themselves along the eastern coast of New Brunswick. The returning Acadians chose sites in the Richibucto, Buctouche, Petitcodiac and Memramcook areas. The settlement at Richibucto which had originally begun in 1750 was re-established as well as settlement at the estuary of the Rivière Saint Charles.

The first seignorial grants, located near the present day Shediac, were given to Acadians in 1772. Settlement of St. Louis-de-

Kent began around 1797 and by 1821 the village had some 76 families. Richibucto, once the hub of the Micmac people, became a centre of shipbuilding and lumbering. With the creation of the counties of Gloucester and Kent in 1827, Richibucto became the Kent County seat. By 1830, this village had become the second largest shipping port in the Province. However, the advent of steam ships and the exhaustion of white pine changed the community's significance as a market centre and there began a shifting in population centres.

Shipbuilding and lumber were the original basis of the economy of many of the coastal settlements in eastern New Brunswick. The community of Rexton, for example, was a thriving shipbuilding and timber exporting centre for 60 years. There were few agricultural communities along the Northumberland coast. These coastal communities were eventually left with a single economic base - fishing.

The coastal Acadian settlements remained separated from the southern part of the province (i.e. Fort St. John) and from the north (i.e. the Gaspe). The Acadians had failed to develop inland where new comers developed successful agricultural communities which were later to become trading and manufacturing centres. Acadian settlements were thus effectively isolated to the coastal zone of the eastern shore line.

The first major settlement by the Acadians inland of the coastal region was made at the end of the 17th century, when a community was established at the bend of the Petitcodiac River. Originally named the "LeCoude" (The elbow or bend), this settlement was destroyed by the British in 1758. The lands originally occupied by the Acadians at "LeCoude" remained vacant until the coming of Dutch-German families from Pennsylvania. These people were tenants under contract to land companies which had received township grants. The township of Moncton was thus established on the north bank of the Petitcodiac River. These first families were followed by a new wave of settlers over the next century.

Moncton's first industry was shipbuilding. The community prospered and the Town of Moncton was incorporated in 1855. The boom did not last however and in 1862, the town's incorporated status was repealed. Moncton was not to become a centre of industry until the late 19th century when the railway boom began.

The Petitcodiac River and the Memramcook River valleys were settled first by the French and then by the English. The settlers reclaimed the rich marshland from the sea with dykes and ditches and farmed the river valleys. Sackville, established in 1761 and the most eastern township in the Province when New Brunswick was incorporated in 1784, became the first permanent English settlement in New Brunswick. During the 19th century, the colonization of the Memramcook Valley by England, Ireland and the United States began. Shipbuilding, lumbering, fur trading, the mercantile businesses as well as farming became the basis of the regional economy.

The Memramcook Valley had an educational significance as well. In 1854, the first French education centre in the Maritimes, St. Thomas College, was established. In 1864, the name was changed to St. Joseph. In 1963, the arts program at St. Joseph's was transferred to the University of Moncton in Moncton and the Institute de Memramcook in the Village of St. Joseph became an adult learning centre.

The colonization of the southwest coast of Fundy Bay, the Chignecto Bay area, was hampered by the granting of a large tract of land to a Colonel Coffen. This grant included three of the area's watercourses which effectively restricted the suitable settlement sites and delayed any settlement in the area until the year 1825, when the Village of Alma was established. Fishing of the Salmon River had always been a summer activity but with the coming of settlers to the area, saw mills proliferated on the region's watercourses. These two activities, fishing and saw mills, soon proved to be uncompatable. Fish stocks were rapidly reduced as a consequence of sawdust pollution of spawning grounds and the need to dam rivers to provide power to run the mills. As the region's natural resources declined, so did the economy based on fish and timber. Between 1870 and 1936, Alma supported 27 families. Today the economic base of the Village of Alma is dependent on the nearby Fundy National Park.

In 1867, upon passage of the British North American Act, New Brunswick became a province in the federated Dominion of Canada.

1.2.2 Confederation Period

The early rural-urban base of the Moncton Planning Region is reflected in the life style of the people today. The Acadian, French and British influence can be seen in much of the architecture, community structure and industry of this southeastern New Brunswick coastal area.

Development in the Moncton Planning Region has been influenced mostly by economic conditions. The City of Moncton, the region's largest centre of population, serves as the commercial, industrial services and transportation centre. Moncton has become a major distribution centre for the Atlantic coast and is sometimes referred to as the "Hub" of the Maritimes because of its geographical location and intensive transportation linkage.

The largest economic sector in the Moncton area is the wholesale trade business. Manufacturing and transportation are the major employers of labor in the area. The development of a manufacturing industry has not been extensive outside of the City of Moncton.

The rate of growth in urban areas has exceeded that of rural areas which are experiencing out-migration. The centres of activity remain along the main highways and the region's estuaries. The major population concentration s along road routes which follow river courses. Development also follows the shoreline and is concentrated near fishing harbours.

Primary industries which traditionally have played a major role in the life of the region's coastal communities continue to support the greatest concentration of people in coastal communities. Consequently, coastal communities have accommodated little change. The fishing of lobster, scallops, herring, clams and oysters, along with the operation of fish processing plants, provide employment for a minor sector of the region's labour force. Nevertheless, commercial salt water fishing remains an important cultural and economic fact for the region's coastal inhabitants.

Fish and wildlife spokesmen suggest that the potential for sport fishing in the region's fresh, estruarial and salt waters remains largely unrealized. The Petitcodiac River Basin now supports 2% of the Province's total effort of 1.3 million sport fishing days. The North River and the Kouchibouguac River support 5% (Hopper, 1979). The estuarine rivers of the Moncton Region are ideal for the pen culture of both sport and commercial fish stock. Fish aquiculture in coastal communities could continue to support a fisheries based culture. The Petitcodiac River is now under extensive fish management and salmon are returning to that river's headwaters tributaries. Lakes throughout the region have potential for more extensive sport fisheries, (Hooper, 1979).

During the 1920's tourism became an integral part of the economic base of the Moncton Region. Climate, beach resources and a coastal zone of estuaries and natural harbours offer recreation potential. Kouchibouguac National Park, located in the northeast of the Moncton region in Kent County and cottage development in the Cocagne and Shediac areas in the southeast are established tourist attractions which attract transient and seasonal residents. The continuing economic development of Moncton as a service and employment centre combined with improved transportation (e.g. Route 15) from the urban to coastal resort areas will, in all probability, promote increases in the number of permanent residences in these coastal communities.

Small family farms support the lifestyle of a samller segment of the region's population. One of the province's two designated primary agricultural districts is located in the southeast peninsula area of Westmorland County. Beef, cattle, hog and dairy farms predominate in the Moncton area. the largest percentage of the province's dairy industry is concentrated in this region. However, the number of small farms is declining as the trend away from subsistance farming continues.

The Moncton Region is the home of the largest segment of New Brunswick's Acadien population. The City of Moncton is a cultural and educational centre for this French speaking population.

1.3 Climate

The Moncton Planning Region is located in southeastern New Brunswick. It lies between 47°05'23" N and 45°31'34" N and between 65°51'00" W and 63°46'20" W. The major portion of the region is located within the New Brunswick Lowlands. The remaining portion lies within the Caledonia Highlands. The elevation of the lowland falls generally between 0 and 90m above sea level. That part of the region lying within the Caledonia Mountains ranges in elevation to 396 m above mean sea level. The elevation at the Petitcodiac River reaches 305 m.

The location of the major portion of the Moncton Region suggests a maritime climate, however, the climate of this region is a modified continential one in nature. It is characterized by a wide range of temperature and an annual rainfall which is somewhat less than that normally found in an oceanic climate. The proximity to the ocean in coastal regions does moderate the region's temperature and ensures relatively even precipitation throughout the year.

WINTER: Generally, the winter season in the Moncton Planning Region begins during the third or fourth week of November. In the Moncton City area, the season (lasting five months) begins in late November and ends in mid April. The winter season in the region's southern-most municipality, Alma, begins in early December and ends in mid April. By April 20th, the east coast, south of the Miramichi, is free of snow. The median duration of snow cover in the northwestern sector of the planning region is generally 150 days, where snow cover persists about 91% of the winter season. Snow cover is less persistent along the Northumberland coast. Throughout much of the lowlands, snow cover is likely about 70% of the time. Snow cover throughout the winter season is less persistent along the Bay of Fundy. (Gates, 1975).

SUMMER: The length of the complete summer season in the Planning Region varies in duration from 6 1/2 months in the Moncton City Area to 7 months in Alma. The duration of high summer is longest in southern New Brunswick. In the coastal sections of the planning region, summer tends to be briefest. Summer draws to a close first along the areas exposed to the Atlantic, then in those sections near the Bay of Fundy.

TEMPERATURE: By the latter part of September, high summer temperatures are restricted to the inland portions of southern New Brunswick. Ocean temperatures reach their maximum in August and along coastal sections. Where summers tend to be briefest, seasonal high temperatures are prolonged. The moderating effect of the ocean causes the annual range to be smaller i.e. 30-40 degrees.

Before the end of May, the average daily high temperatures except near the coast, are in excess of $18^{o}C$ over most of the southern half of New Brunswick. The mean annual daily temperature in the southern part of the region along the Bay of Fundy is $5.3^{o}C$. Generally, throughout the region the mean annual daily temperature is between $5\text{-}6^{o}C$. Moncton records the highest mean daily maximum temperature of $11^{o}C$ and the remaining stations in the region stay close to $10^{o}C$. Moncton also records the mean daily minimum temperature of $-0.1^{o}C$.

PRECIPITATION: The total annual precipitation is the sum of the annual rainfall plus one-tenth of the annual snowfall. About 20-30% of the total precipitation originates as snow, as shown in Table (1.1). This percentage is slightly less for coastal locations. The total annual precipitation within the planning region varies from 1,015 mm (Buctouche) to 1,390 mm (Alma). Figures (1.2) and (1.3) show the mean annual precipitation in mm and the mean total snowfall in cm, respectively, within the planning region.

Further details related to the climate of the region can be obtained from Environment Canada, Meteorological Application Branch, (Gates, 1975).

There are approximately 50 climatological stations situated throughout the Moncton Planning Region. Approximately 20 of these are active stations. The region's prime synoptic station is Moncton Airport. Climatological data at stations with sufficient lengths of record is presented in Table (1.1). The data from two stations, located outside the boundary of the Moncton Planning Region have been included.

Table (1.1)CLIMATOLOGICAL DATA IN THE MONCTON PLANNING REGION

PARAMETER	STATION				
	Alma	Buctouche	Chatham A*	Dawson Settlement	Harcourt
Annual Temp C^{o}					
Mean Daily	5.3	5.6	4.8	5.4	4.0
Mean Daily Max.	10.0	10.1	10.2	9.9	10.2
Mean Daily Min.	0.6	1.1	-0.6	0.8	-2.2
Extreme Temp					
Maximum ^{o}C	32.0	34.5	37.8	33.3	35.0
Minimum ^{o}C	-30.6	-30.0	-35.0	-29.4	-42.8
Frost Free Period (Day 6)	147	N/A	122	N/A	N/A
Annual Precipitation					
Mean Rainfall mm	1161.8	746.8	760.6	873.4	831.9
Mean Snowfall cm	226.3	271.9	333.1	448.8	324.3
Mean Total Pcpn. mm	1390.9	1015.7	1096.7	1321.6	1132.7

*Station is outside the Moncton Planning Region

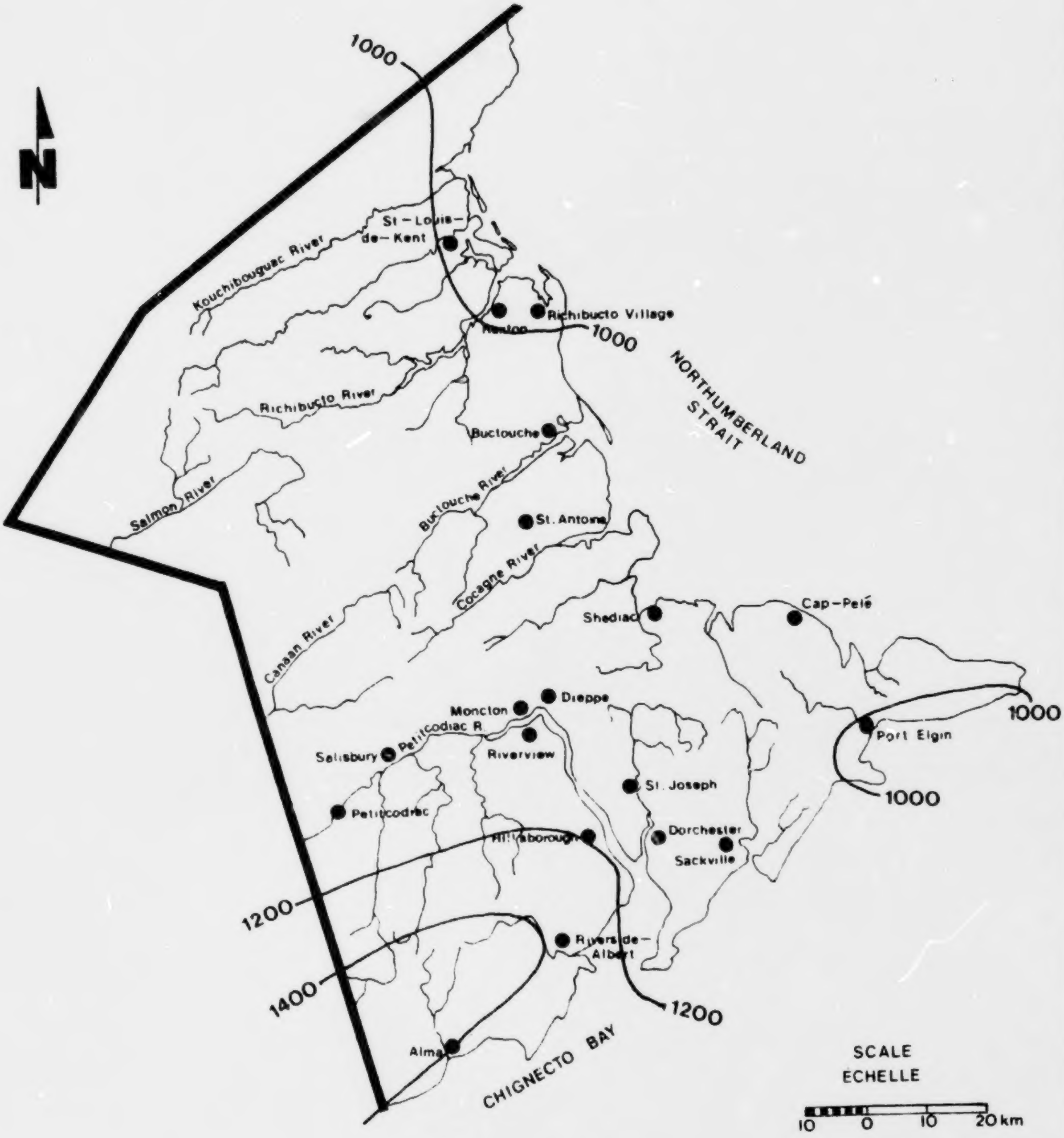
TABLE (1.1) Continued

PARAMETER	STATION				
	Moncton	Moncton A	Rexton	Sackville	Sussex*
Annual Temp C$^{\circ}$					
Mean Daily	5.5	5.2	4.9	5.7	5.4
Mean Daily Max.	11.0	10.3	10.4	10.3	11.2
Mean Daily Min.	-0.1	0.0	-0.7	1.0	-0.4
Extreme Temp C$^{\circ}$					
Maximum $^{\circ}$C	36.7	37.2	39.4	36.1	37.2
Minimum $^{\circ}$C	-37.8	-32.2	-39.4	-33.3	-44.4
Frost Free Period (Days)	102	122	116	134	102
Annual Precipitation					
Mean Rainfall mm	794.1	810.1	833.5	914.6	849.0
Mean Snowfall cm	301.2	341.2	223.3	218.0	212.9
Mean Total Pcpn. mm	1094.6	1179.0	1057.5	1135.3	1062.6

*Station is outside the Moncton Planning Region

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


1000
N
St-Louis-de-Kent
Kouchibouguac River
Richibucto Village
Rexton
1000
NORTHUMBERLAND STRAIT
Richibucto River
Buctouche
Salmon River
Buctouche River
St. Antoine
Cocagne River
Canaan River
Shediac
Cap-Pelé
Dieppe
Moncton
1000
Port Elgin
Salisbury
Petitcodiac R.
Riverview
1000
St. Joseph
Petitcodiac
Hillsborough
Dorchester
Sackville
1200
Riverside-Albert
1400
1200
Alma
CHIGNECTO BAY
SCALE
ECHELLE
10 0 10 20 km

LEGEND
LÉGENDE

- REGION BOUNDARY
  LIMITES DE LA RÉGION
- ISOLINES
  ISOGRAMME

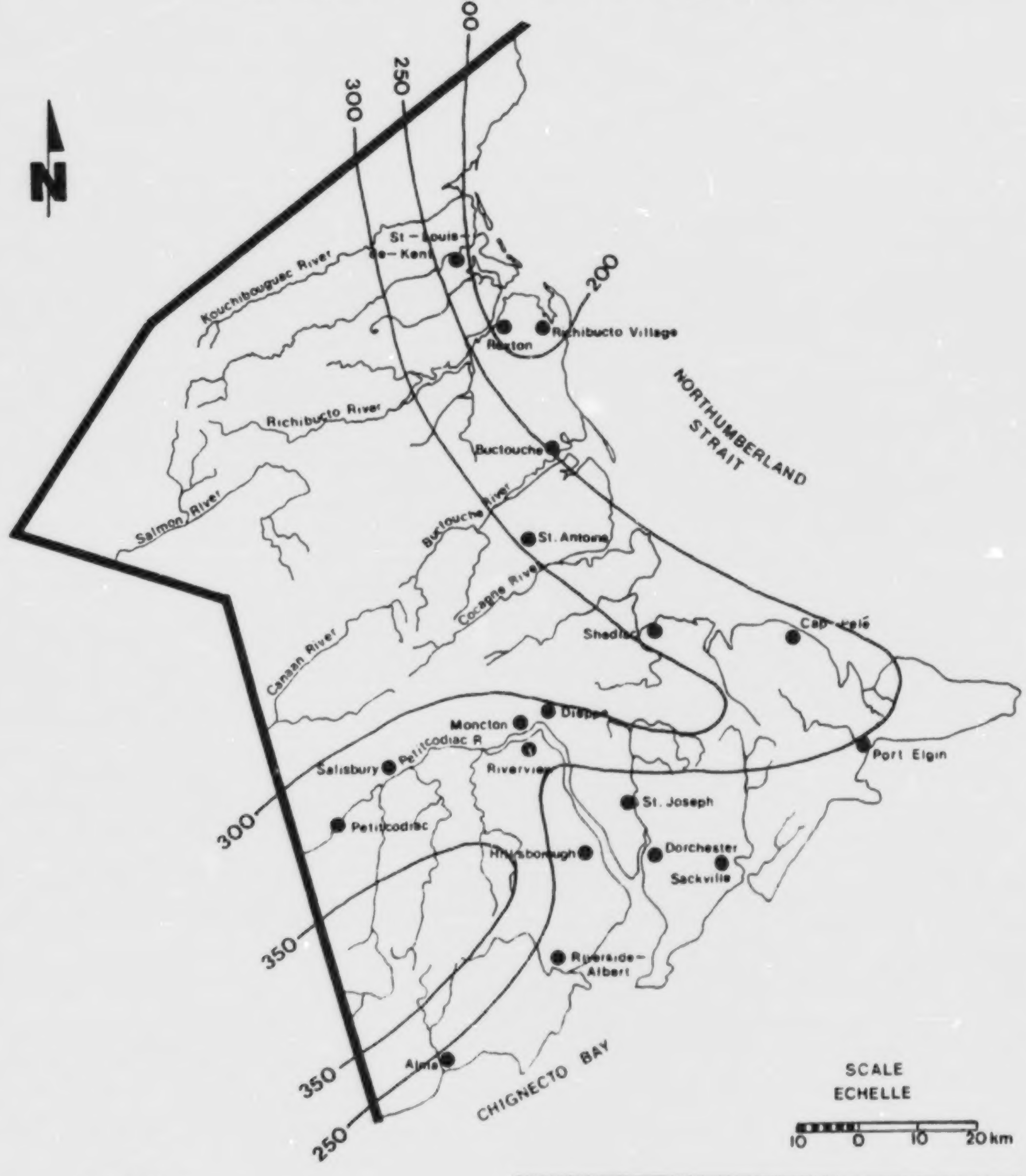
MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ÉTUDE DES RESSOURCES EN EAU

MEAN TOTAL ANNUAL PRECIPITATION (mm)
PRÉCIPITATION ANNUELLE MOYENNE TOTAL (mm)

FIG. 1.2

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


N
200
250
300
St-Louis-de-Kent
200
Kouchibouguac River
Rexton
Richibucto Village
Richibucto River
NORTHUMBERLAND STRAIT
Buctouche
Salmon River
Buctouche River
St. Antoine
Cocagne River
Canaan River
Shediac
Cap-Pelé
Dieppe
Moncton
Petitcodiac R
Riverview
Salisbury
Port Elgin
St. Joseph
300
Petitcodiac
Hillsborough
Dorchester
Sackville
350
Riverside-Albert
Alma
350
CHIGNECTO BAY
250
SCALE
ECHELLE
10
0
10
20 km

LEGEND
LÉGENDE

REGION BOUNDARY
LIMITES DE LA RÉGION
ISOLINES
ISOGRAMME

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

MEAN TOTAL ANNUAL SNOWFALL (cm)
ÉPAISSEUR DE NEIGE ANNUELLE MOYENNE TOTALE (cm)

FIG.1.3

1.4 Physiography and Geology

The Moncton Planning Region comprises portion of the Maritime Plain and the New Brunswick Highlands physiographic subdivisions, Figure (1.4).

The northern and eastern two-thirds of the region is dominated by the relatively flat topography and low relief of the Maritime Plain. The bulk of this area lies at elevations between 60 and 90 metres a.s.l. (above sea level), with maximum elevations of about 120 metres a.s.l. occurring locally in the uninhabited portions of western Huskisson and Harcourt Parishes. Elevations decline imperceptibly in an eastward direction to the coast of Northumberland Strait. Drainage courses are incised into the plain commonly by 7.5 to 15 m and locally in the near coastal area by up to 30m or a little more in the case of larger streams. Stream gradients are generally fairly low. In the divide area between coastward draining streams and inland-draining streams in Kent County, the drainage pattern is poorly developed and sphagnum bogs are common features. The extension of the Maritime Plain eastwards in the Shediac to Port Elgin area is marked by similar topography, but lower maximum elevations.

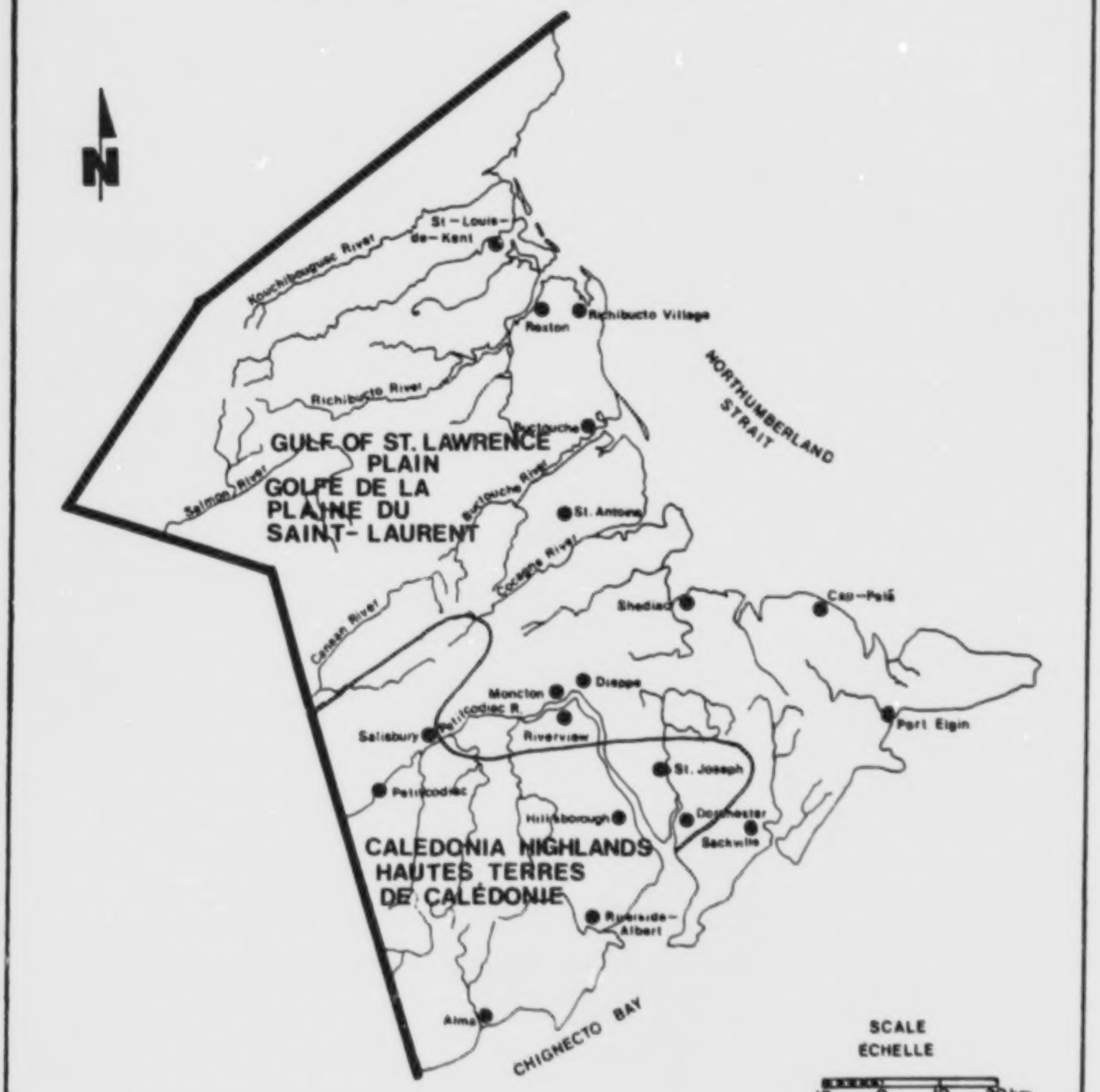
The southern portion of the region is characterized by the more rugged topography of the Caledonia Highlands section of the New Brunswick Highlands. The north wing of the Highlands, lying north of the Petitcodiac River, exhibits rolling topography with rounded hills and northeastward - elongated ridges. Elevations are largely between 60 and 120 m, with a few hilltops at about 150 m elevation. The area is drained by a consequent stream with a pattern reflecting the parallel ridge and valley topography at least in the headwater areas.

The main body of the Caledonia Highlands between the Petitcodiac River and the Fundy coast exhibits a rolling plateau surface at about 300 to 360 m elevation, with a local maximum elevation of about 400m in the eastern portion of Elgin Parish. A rejuvenated drainage system of short, coastward-flowing dendritic streams is incising itself into the southeastern front of the plateau, resulting in rugged precipitous topography along this front. The northwestern front of the plateau displays similar dendritic drainage in a somewhat more mature and dissected topographic setting.

The central depression of the Highlands drains into the head of tne Bay of Fundy via the Petitcodiac River and its tributaries. The Petitcodiac is a mature,low-gradient stream while many of its tributaries, especially those flowing in from the south have more youthful profiles. Much of the basin of the Petitcodiac itself might best be considered as a tongue of the Maritime Plain intruding on the Highland, being geologically and topographically similar to the Plain subdivision.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


N
St-Louis-de-Kent
Kouchibouguac River
Rexton
Richibucto Village
Richibucto River
Buctouche
NORTHUMBERLAND STRAIT
GULF OF ST. LAWRENCE PLAIN
GOLFE DE LA PLAINE DU SAINT-LAURENT
Salmon River
Buctouche River
St. Antoine
Cocagne River
Canaan River
Shediac
Cap-Pelé
Moncton
Dieppe
Petitcodiac R.
Salisbury
Riverview
St. Joseph
Port Elgin
Petitcodiac
Hillsborough
Dorchester
Sackville
CALEDONIA HIGHLANDS
HAUTES TERRES DE CALÉDONIE
Riverside-Albert
Alma
CHIGNECTO BAY
SCALE
ÉCHELLE
10 0 10 20 km

LEGEND
LÉGENDE

▬	REGION BOUNDARY LIMITES DE LA RÉGION
—	PHYSIOGRAPHIC BOUNDARY LIMITS PHYSIOGRAPHIQUES

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

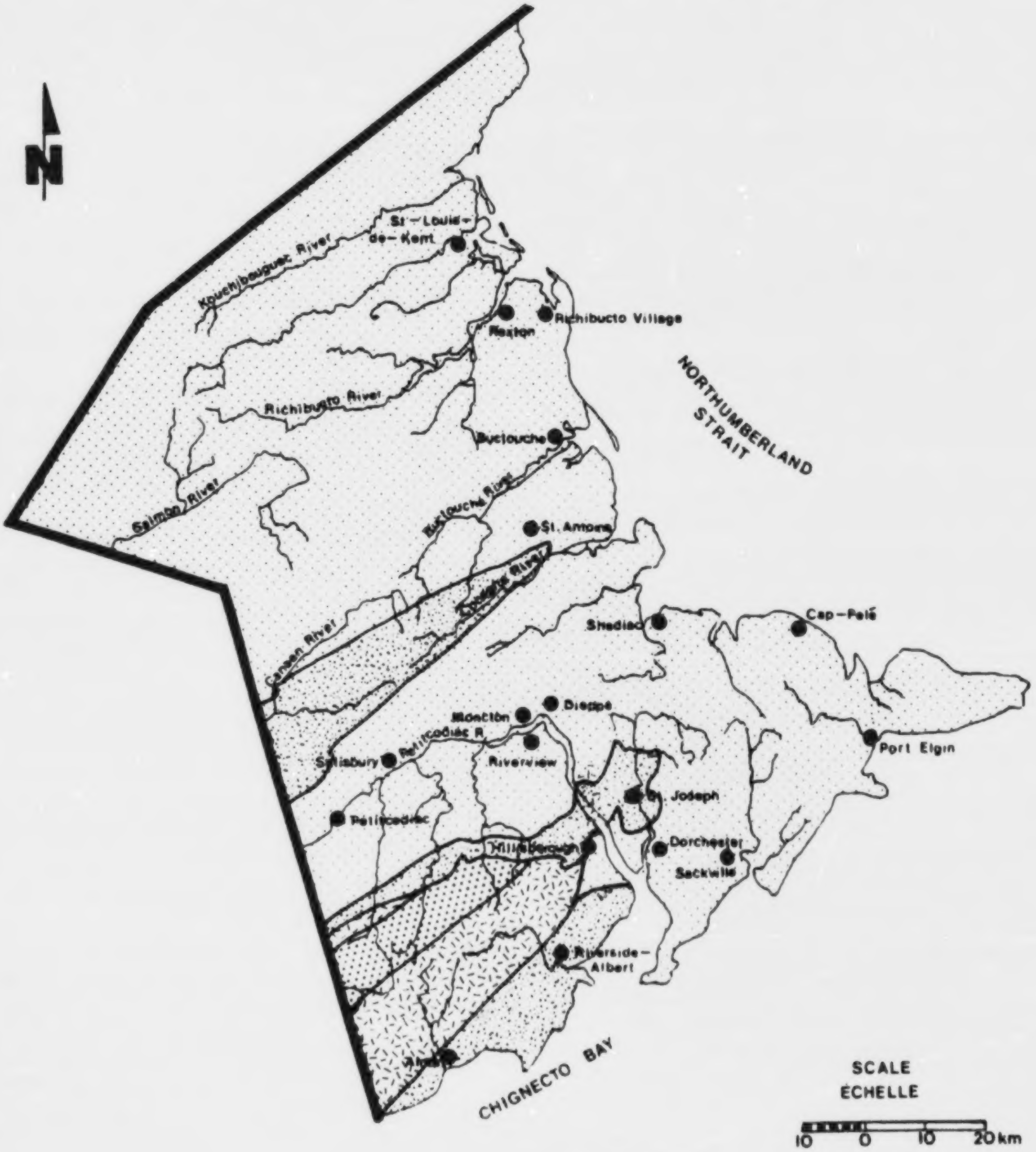
PHYSIOGRAPHY OF THE REGION
PHYSIOGRAPHIE DE LA RÉGION

The Caledonia Highlands include rock units ranging in age from Precambrian to Pennsylvanian and one minor occurrence of Triassic sediments. The core of the Highlands, in the Fundy coastal area, comprises a complex of Precambrian sedimentary and volcanic rocks and their metamorphic equivalents, intruded by granitic to gabbroic igneous rocks, some of which may be as young as Devonian.

This complex is flanked on the northwest by a band of Mississippian sandstone, conglomerate and shale that laps onto the Precambrian basement. The Mississippi sediments extend eastwards across the mouth of the Petitcodiac River to the vicinity of Memramcook. The same unit makes up most of the north limb of the Highlands nortn of the Petitcodiac River. Closely associated with this unit in the area east of the Petitcodiac River is a unit of conglomerate and siltstone of Mississippian to Pennsylvanian age, with related volcanic flows. The outer limit of the Mississippian-Pennsylvanian age, with related volcanic flows. The outer limit cf the Mississippian-Pennsylvanian unit largely defines the eastern extremity of the Highlands. This unit, in association with some Pennsylvanian strata, also forms the elongate ridges of the New Horton and Cape Enragé area.

The New Brunswick Lowland is underlain by a complex of Pennsylvanian sediments including sandstone, conglomerate and siltstone. This is an alluvial basin-fill system characterized by complex vertical stratigraphy and horizontal facies changes resulting in extremely variable rock textures and aquifer properties. The unit was built up by meandering river systems, with river channel deposits being coarse-grained and flood plain deposits being fine-grained, giving rise to the siltstones. Frequent changes in the river courses resulted in overlapping relationships and complex, repetitive interstratification. Many stratigraphic subunits are of lenticular form, with limited areal extent. The bedrock geology of the Moncton Planning Region is shown in Figure (1.5).

Surficial materials in the planning region consist mostly of sandy to loamy glacial lodgement till to the north of the main body of the Highlands, and stony lodgement till throughout the main Highland area to the Bay of Fundy. The till usually occurs as a blanket about 0.5 to 1.5 m thick over bedrock, with locally thicker accumulations. Smaller areas of thin morainal veneer, where similar till is generally less than 0.5 m thick, are scattered throughout the region and are common on steep flanks of the Highland. Thicker lodgement till occurs in a corridor extending eastwards from Salisbury, through Moncton and including a major portion of the area east to Cape Tormentine. Till deposits in this area are generally greater than 1.5 m in thickness. Areas of exposed bedrock with little surface cover are associated with some bedrock ridges, stream valleys along the Fundy coast, and certain localities in eastern Kent County.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Salmon River
Buctouche River
St. Antoine
Cocagne River
Canaan River
Shediac
Cap-Pelé
Moncton
Dieppe
Petitcodiac R.
Riverview
Salisbury
Port Elgin
St. Joseph
Petitcodiac
Hillsborough
Dorchester
Sackville
Riverside-Albert
Alma
CHIGNECTO BAY
SCALE
ÉCHELLE
10 0 10 20km

LEGEND
LÉGENDE

▬ REGION BOUNDARY
LIMITES DE LA RÉGION
▤ PENNSYLVANIAN
▨ MISSIPPIAN
▩ DEVONIAN GRANITIC ROCKS
▧ LATE PRECAMBRIAN-CAMBRIAN-ORDIVICIAN

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

BEDROCK GEOLOGY OF THE REGION
GÉOLOGIE DU ROCHER EN PLACE
DANS LA RÉGION

FIG. 1.5

Morainal systems comprising loose to gravelly glacial ablation till from discontinuous bands north of Moncton, extending from the Canaan Forks area nearly to Cape Tormentine, and also through the Anagance-Petitcodiac River depression eastwards to the Sackville area. Surficial materials in these deposits are generally greater than 1.5m thick and may locally be up to about 10-15 m thick.

Sand and gravel occur rather uncommonly as widely scattered esker, kame and glaciofluvial outwash deposits in the uplands, and as stream alluvium locally in the river valleys. A blanket of early post-glacial marine sand and silt is found overlying till or bedrock in a band within about 2 to 10 km of the Northumberland Strait coast, mainly in Kent County. This material is generally up to about 1.5 m thick, but is locally substantially thicker in bedrock depressions.

CHAPTER TWO

THE WATER RESOURCES

2.1 Regional Review by Area

The surface and ground water availability and quality in the Moncton Planning Region are discussed in this chapter. The region has been divided into six areas according to the hydrometric drainage index subdivision defined by the Water Survey of Canada.

Detailed descriptions of each area including location, major watercourses and surficial and bedrock geology are presented in this chapter. Major domestic and industrial water users and major water-based activities are also defined and discussed for each of the areas.

Additional information related to each of the six areas can be found in Appendices C, D and E of this report. Such information includes lists of hydrometric and water quality stations, flow duration analyses and low flow frequency analyses of available historical data at the hydrometric stations. A comprehensive list of watercourses in each are is presented in Appendix F. This list provides drainage area, basin length, basin perimeter and basin shape coefficients for each watercourse. These coefficients are defined in Appendix B.

2.1.1 Preamble

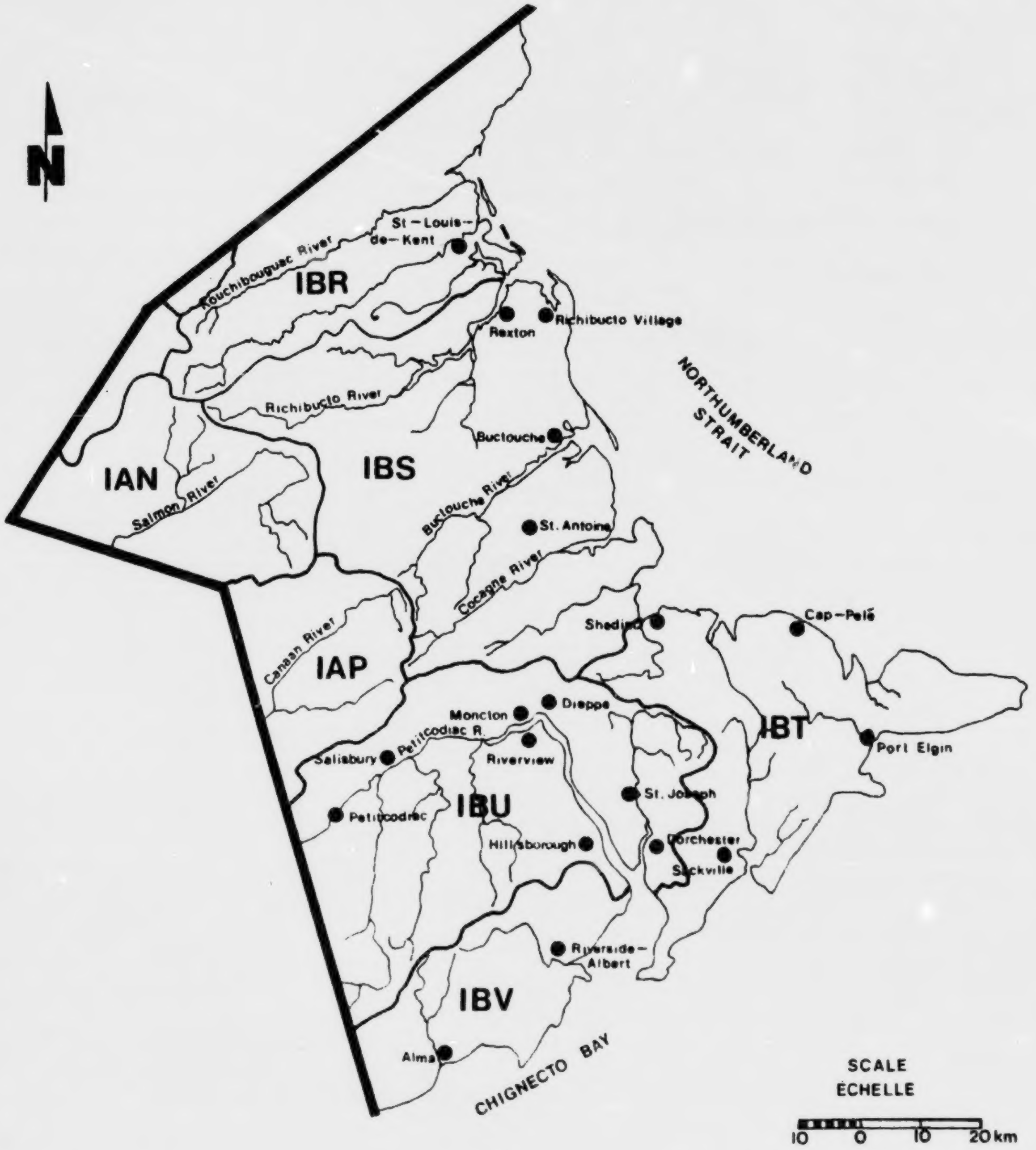
Detailed reviews of the water resources in the six areas within the Moncton Planning Region are presented in the following sections. The designation of each of these areas, which are shown in Figure (2.1) is given below along with the area name:

AREA NAME	DRAINAGE INDEX SUBDIVISION	ENTIRE N.B. INDEX IS IN REGION	ENTIRE INDEX TO BE DISCUSSED
Fundy	1BV	No	No
Sackville-Shediac	1BT	Yes	Yes
Petitcodiac Basin	1BU	No	Yes
Eastern Shore	1BS	Yes	Yes
Kouchibouquac	1BR	No	No
Upper Salmon	1AN 1AP	No	No

Drainage index subdivision 1BU will be completely discussed within this report although portions of the area are outside the boundary of the Moncton Planning Region. Drainage index subdivisions 1BT and 1BS lie completely within the planning region and will be discussed in their entirety in this report.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


N
IBR
IAN
IBS
IAP
IBU
IBT
IBV
Kouchibouguac River
St-Louis-de-Kent
Rexton
Richibucto Village
Richibucto River
Buctouche
Salmon River
Buctouche River
St. Antoine
Cocagne River
Canaan River
Shediac
Cap-Pelé
Moncton
Dieppe
Petitcodiac R.
Salisbury
Riverview
Petitcodiac
St. Joseph
Port Elgin
Hillsborough
Dorchester
Sackville
Riverside-Albert
Alma
NORTHUMBERLAND STRAIT
CHIGNECTO BAY
SCALE
ÉCHELLE
10
0
10
20 km

LEGEND
LÉGENDE

▬ REGION BOUNDARY
LIMITES DE LA RÉGION
— HYDROMETRIC BOUNDARY
LIMITES HYDROMÉTRIQUES

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

THE AREAS
LES SECTEURS

FIG. 2.1

Only those portions of the drainage index subdivision 1BV, 1BR, and 1AN & 1AP which lie within the boundary of the Moncton Planning Region will be discussed here, Drainage index subdivisions 1BV and 1AP have been discussed in the Saint John Planning Region Water Resources Review, (New Brunswick Department of the Environment, 1977). Drainage index subdivision 1BR has been discussed in the Chatham-Newcastle Planning Region Water Resources Review, (New Brunswick Department of the Environment, 1984).

2.1.2 Water Availability

Runoff varies over the year for a number of reasons of which precipitation, temperature, evapotranspiration and storage are the most important. High seasonal flows are generally experienced in April and May in most rivers within the planning region. Following this spring period, streamflows gradually decrease as the surface and groundwater storage is slowly depleted. This decrease usually continues throughout the summer months, particularly due to the high rate of evapotranspiration. A net increase in runoff is then experienced in the fall due to lower temperatures and the lower rate of evapotranspiration. In the winter months, most of the precipitation is stored within the snowpack; this phenomenon is more pronounced on high ground within the region. As the majority of winter precipitation is captured in the snow pack, runoff is mainly derived from groundwater and surface storage.

The Petitcodiac River is the largest river in the planning region. The Petitcodiac River is a tidal river which originates at a point 14 km west of the Village of Salisbury and flows 34 km to the bend at Moncton at Halls Creek and thence into Shepody Bay, the Chignecto Bay and the Bay of Fundy. The river drains portions of three counties, Kings, Albert and Westmorland. Roughly 65 percent of the basin is located on the south side of the Petitcodiac and Anagance Rivers. The drainage area of the Petitcodiac River is 2,071 km^2, the meander length to its mouth (Dover-Stoney Creek) is 79 km, the average is 2.1 m/km and the mean annual flow is 34.8 m^3/sec. The upper portions of the river are relatively fast flowing as far as Petitcodiac. In the lower reaches, between Salisbury and its mouth, the river is wide and slow flowing.

The Richibucto River is the second largest river within the planning region. This river has a drainage area of 1,077 km^2 and flows northeasterly into Northumberland Strait.

Salmon River and Canaan River have significant drainage areas with headwaters within the planning region. However, both rivers discharge into major watercourses outside of the Moncton Planning Region and for this reason will not be discussed in detail in this report. A list of the major rivers within the Moncton Planning Region is presented in Table (2.1).

TABLE (2.1)

LIST OF MAJOR RIVER BASINS
MONCTON PLANNING REGION

DRAINAGE INDEX SUBDIVISION	RIVER NAME	DRAINAGE AREA (sq. km)
1AN	Salmon River	1863.7
1AP	Canaan River	1558.5
1BR	Kouchibouguac River	392.3
1BR	Black River	133.1
1BR	Kouchibouguacis River	131.3
1BR	Riviére St. Charles	117.9
1BS	Coal Branch River	213.1
1BS	Bass River	116.0
1BS	St. Nicholas River	200.5
1BS	Buctouche River	426.6
1BS	Cocagne River	297.3
1BS	Shediac River	221.8
1BS	Richibucto River	1077.4
1BT	Scoudouc River	151.8
1BT	Gaspereau River	130.7
1BT	Tantramar River	202.0
1BU	North River	290.2
1BU	Anaganse River	144.5
1BU	Pollett River	309.4
1BU	Little River	297.6
1BU	Petitcodiac River	2071.6
1BU	Memramcook River	398.6
1BV	Shepody River	159.3
1BV	Upper Salmon River	190.7

The lakes found in the Moncton Region occupy approximately 15 km^2 or 0.2% of the Region's total area of approximately 10,230 km^2. The most prominent lakes are found the the Sackville Shediac area (1BT), Square Lake, Jolicure Lake, Big Bolicure Lake and Morice Pond. Table (2.2) lists the lakes within the Moncton Region.

A large number of dams of various sizes have been constructed on watercourses within the planning region. Table (2.3) presents a list of these dams and identifies the status of each, whether active, inactive or breached. This list was largely based on photo interpretive methods (Haig, 1980). The photographs used were those obtained in the period 1974-1976.

Groundwater Availability

The majority of individual domestic water supplies in the area are probably obtained from wells drilled in bedrock. Fracture permeability is likely the most important mode of groundwater transmission in the bedrock, as opposed to inter-granular permeability. Some component of intergranular permeability may, however, contribute to yields in the Pennsylvanian rocks. Shallow dug wells collecting water from overburden are important locally.

Precambrian complex: In the largely Precambrian complex of the Highland core, the most likely depth for finishing a well was in the 25 to 40 m range, which accounted for 34% of all wells in this unit (Figure A). Wells in this unit tend to be moderately deep, with a further 23% finished in the 50 to 80 m depth range. It is, however, not uncommon to encounter water at shallower depths, as the graph indicates. The frequency of well yields in this unit is concentrated in the 0.15 - 0.4 l/sec range, which accounts for 53% the recorded wells (Figure A). Larger yields are sometimes encountered, but are less common.

Mississippian rocks: Statistics for the Mississippian sediments were developed from data on a group of wells in the Cornhill-Havelock--Lewis Mountain area of the north limb of the Highlands. It is assumed that the information is valid for other smaller outcrop areas of the same unit, for which it is difficult to isolate data. There is no sharp modal point in the distribution of well depths within the Mississippian unit, with an almost equal probability of finishing a well in any 3m depth range between about 20 and 40 m (Figure B). This group accounts for 58% of the documented wells in the unit. Wells up to 80 m deep are fairly common, but few are greater than this depth. Generally, the depth distribution is broadly similar to that noted in the Precambrian unit. The most common yield range in the Mississippian is between 0.15 and 0.45 l/sec, this group representing 49% of all the wells (Figure B). Within this group, the numbers are skewed towards the higher yields, while in the Precambrian, the skewness is towards the lower

TABLE (2.2)

LIST OF LAKES IN THE MONCTON REGION

Lake	Parish	County	Area SQ.KM.
1AN			
Spectacle Lake	Harcourt	Kent	.05
Trout Brook Lake	Harcourt	Kent	.17
Big Forks Lake	Harcourt	Kent	.07
1BR			
Francis Lake	Auskisson	Kent	.04
Lac à Jos-Wilfred	Saint-Louis	Kent	.04
Kent Lake	Saint-Charles	Kent	.19
Meadow Lake	Huskisson	Kent	.21
Sabbies Lake	Huskisson	Kent	.09
Jardine Lake	Saint-Charles	Kent	.10
Lac a Livain	Carleton	Kent	.41
Lac das Irlandais	Carleton	Kent	.21
Laketon Lake	Carleton	Kent	.27
Round Lake	Carleton	Kent	.24
McLain Lake	Huskisson	Kent	.33
Sullivans Lake	Carleton	Kent	.05
1BS			
Lac St. Joseph	Welford	Kent	.14
Geddes Lake	Richibucto	Kent	.14
Coal Branch Lake	Harcourt	Kent	.44
Birch Ridge Lake	Harcourt	Kent	.16
Lac de Bon-Secours	Saint-Paul	Kent	.07
Adamsville Lake	Harcourt	Kent	.04
1BV			
Marven Lake	Alma	Albert	.04
Chambers Lake	Alma	Albert	.03
Caribou Lake	Alma	Albert	.02
Bennett Lake	Alma	Albert	.24
Laverty Lake	Alma	Albert	.03
Tracey Lake	Alma	Albert	.06
Bruin Lake	Alma	Albert	.02
Stanyard Lake	Hillsborough	Albert	.07
McFadden Lake	Harvey	Albert	.15
Livingstone Lake	Alma	Albert	.08
Square Lake	Alma	Albert	.09
Richardson Lake	Harvey	Albert	.10
Lockhart Lake	Harvey	Albert	.35

TABLE (2.2) Continued

LIST OF LAKES IN THE MONCTON REGION

Lake	Parish	County	Area SQ.KM.
1BV (Cont.)			
New Horton Lake	Harvey	Albert	.57
Priest Lake	Harvey	Albert	.04
1BT			
Poucette Lake	Shediac	Westmorland	.28
Square Lake	Botsford	Westmorland	1.31
Niles Lake	Botsford	Westmorland	.40
Collins Lake	Botsford	Westmorland	.64
Black Lake	Sackville	Westmorland	.19
Long Lake	Sackville	Westmorland	.67
Fawcett Lake	Sackville	Westmorland	.02
Patterson Lake	Sackville	Westmorland	.14
Pink Rock Lake	Sackville	Westmorland	.02
Dwyers Lake	Westmorland	Westmorland	.09
Jolicure Lake	Westmorland	Westmorland	1.09
Big Jolicure Lake	Sackville & Westmorland	Westmorland	1.47
Morice Pond	Sackville	Westmorland	1.45
Johnson Lake	Sackville	Westmorland	.13
Dave Lake	Sackville	Westmorland	.08
1BU			
Grassy Lake	Elgin	Albert	.06
Big Lake	Sackville	Westmorland	.04
Folly Lake	Dorchester	Westmorland	.19
Melanson Settlement Lake	Moncton	Westmorland	.13
Blackwood Lake	Elgin	Albert	.10
Memramcook Lake	Dorchester	Westmorland	.30

TABLE 12.5 LIST OF DAMS IN THE MONCTON PLANNING REGION

No.	Hydrometric No.	Name of Dam	Watercourse	County	Type of Dam	Dam Height (m)	Spillway Type	Status
1	AN5	-	W.Br. Little Forks R.	Kent	-	-	-	Breached
2	BR1	Kouchibouguac	Kouchibouguac River	Kent	concrete	6.0	conc. overflow	Inactive
3	BR2	-	Jean-Pierre Brook	Kent	-	-	-	-
4	BR3	-	Unnamed	Kent	-	-	-	-
5	BS1	Warren Mills	St. Nicholas River	Kent	wooden	-	-	Breached
6	BS2	Irving's (St. Edward)	-	Kent	earth	-	wood overflow	Active
7	BS3	-	N.Forks Coal Br. R.	Kent	wooden	-	-	Breached
8	BS4	-	St. Nicholas River	Kent	-	-	-	Active
9	BS5	-	Unnamed	Kent	-	-	-	-
10	BS6	Bailey Brook	Bailey Brook	Kent	earth	-	-	Breached
11	BS7	-	Black River	Kent	-	-	-	-
12	BS8	-	N. Chockpish River	Kent	-	-	-	-
13	BS9	-	W.Br. St. Nicholas R.	Kent	-	-	-	-
14	BS10	-	Cocagne River	Westmorland	-	-	-	-
15	BT1	St. Anne Dam	Unnamed	Westmorland	-	-	-	Removed
16	BT2	Square Lake Dam	Square Lake	Westmorland	earth	-	-	Breached
17	BT3	-	Chapman Brook	Westmorland	-	-	-	-
18	BT4	Boudreau Dam	Unnamed	Westmorland	earth	-	timber	Breached
19	BT5	-	Unnamed	Westmorland	-	-	-	-
20	BT6	-	Unnamed	Westmorland	-	-	-	-
21	BT7	-	McKay Brook	Westmorland	-	-	-	-

TABLE (2.3) LIST OF DAMS IN THE MONCTON PLANNING REGION

No.	Hydro-metric No.	Name of Dam	Watercourse	County	Type of Dam	Dam Height (m)	Spill-way Type	Status
22	BT8	-	Ward Brook	Westmorland	-	-	-	Active
23	BT9	-	Rayworth	Westmorland	-	-	-	Active
24	BT10	-	Unnamed	Westmorland	-	-	-	Inactive
25	BT11	-	Unnamed	Westmorland	-	-	-	Active
26	BT12	-	Unnamed	Westmorland	-	-	-	Active
27	BT13	-	Unnamed	Westmorland	-	-	-	Inactive
28	BT14	-	Unnamed	Westmorland	-	-	-	Active
29	BT15	-	Unnamed	Westmorland	-	-	-	Active
30	BT16	-	Morice Lake	Westmorland	-	-	-	Active
31	BT17	-	Unnamed	Westmorland	earth & timber crib	1.5	timber chute	Breached
32	BT18	-	Tantramar River	Westmorland	-	-	-	Inactive
33	BT19	-	Trout Lake	Westmorland	-	-	-	Inactive
34	BT20	-	Unnamed	Westmorland	-	-	-	-
35	BT21	-	Unnamed	Westmorland	-	-	-	-
36	BT22	-	Frosty Hollow Lake	Westmorland	earth	3.8	timber chute	Active
37	BT23	-	Frosty Hollow Brook	Westmorland	earth	3.0	concrete chute	Active
38	BT24	-	Unnamed	Westmorland	-	-	-	-
39	BT25	Tantramar River Tidal	Tantramar River	Westmorland	rockfill	13.0	conc. gated	Active
40	BT26	-	Aulac River	Westmorland	earth	7.5	conc. aboi-deau	Active
41	BT27	-	Unnamed	Westmorland	-	-	-	-
42	BT29	-	Musquash Brook	Westmorland	-	-	-	-

TABLE (2.3) LIST OF DAMS IN THE MONCTON PLANNING REGION

No.	Hydrometric No.	Name of Dam	Watercourse	County	Type of Dam	Dam Height (m)	Spillway Type	Status
43	BT30	-	Allen Brook	Westmorland	-	-	-	-
44	BT31	-	Kinnear River	Westmorland	-	-	-	-
45	BT32	-	Unnamed	Westmorland	-	-	-	-
46	BT33	-	Unnamed	Westmorland	-	-	-	Breached
47	BU1	-	Unnamed	Westmorland	-	-	-	-
48	BU2	-	Unnamed	Westmorland	-	-	-	-
49	BU3	Havelock Quarry	Unnamed	Westmorland	earth	-	-	Breached
50	BU4	Magnetic Hill Game Farm	W.Br. Halls Creek	Westmorland	wooden	-	-	Inactive
51	BU5	McLaughlin Road	N.Br. Halls Creek	Westmorland	earth	20.0	conc. chute	Active
52	BU6	Irishtown Road	Ogilvie Brook	Westmorland	earth & concrete	7.75	conc. chute	Active
53	BU7	-	Jonathan Creek	Westmorland	-	-	-	Active
54	BU8	-	Humphrey Creek	Westmorland	-	-	-	Active
55	BU10	Jones Lake	Jones Creek	Westmorland	earth	-	conc. box inlet	Active
56	BU11	Naval Base	Mill Creek	Westmorland	concrete	5-6	conc. weir	Active
57	BU12	Turtle Creek	Turtle Creek	Albert	earth	21.9	conc. chute	Active
58	BU13	-	Steeves Creek	Westmorland	-	-	-	Active
59	BU15	Pollett River	Pollett River	Westmorland	timber	-	-	Breached
60	BU19	-	LeBlanc Creek	Westmorland	..	-	-	Active
61	BU20	Gypsum	Unnamed	Albert	conc. gravity	3.0	-	Breached
62	BU21	Hawks Pond	Unnamed	Albert	-	-	-	Active
63	BU22	-	Breau Brook	Westmorland	-	-	-	-

TABLE (2.3) LIST OF DAMS IN THE MONCTON PLANNING REGION

No.	Hydro-metric No.	Name of Dam	Watercourse	County	Type of Dam	Dam Height (m)	Spill-way Type	Status
64	BU23	-	Keillor Brook	Westmorland	-	-	-	-
65	BU24	-	Pollett River	Westmorland	-	-	-	Breached
66	BU25	-	Pollett River	Westmorland	-	-	-	-
67	BU26	-	O'Blenis Brook	Westmorland	-	-	-	-
68	BU27	-	Robinson Brook	Westmorland	-	-	-	-
69	BU28	-	Shaw Brook	Albert	-	-	-	-
70	BU29	-	Canadian Brook	Albert	-	-	-	-
71	BU30	-	Unnamed	Albert	earth	2.2	conc. over-flow	Active
72	BU31	-	Mud Creek	Albert	-	-	-	Breached
73	BU32	-	Babineau Creek	Westmorland	-	-	-	-
74	BU33	-	Unnamed	Westmorland	-	-	-	-
75	BU34	-	Unnamed	Westmorland	-	-	-	-
76	BU35	-	Gorge Brook	Westmorland	earth	3.6	conc. pipe	Active
77	BU36	-	Gorge Brook	Westmorland	earth & rock	4.0	rock	Active
78	BU38	-	Rabbit Brook	Westmorland	-	-	-	-
79	BU39	-	Jonathan Creek	Westmorland	-	-	-	-
80	BU40	-	Unnamed	Westmorland	-	-	-	-
81	BU41	-	Unnamed	Westmorland	-	-	-	-
82	BU42	-	Unnamed	Westmorland	-	-	-	-
83	BU43	-	Smith Brook	Westmorland	-	-	-	-
84	BU44	-	Pollett River	Albert	-	-	-	Breached

TABLE (2.3) LIST OF DAMS IN THE MONCTON PLANNING REGION

No.	Hydrometric No.	Name of Dam	Watercourse	County	Type of Dam	Dam Height (m)	Spillway Type	Status
85	BV23	Bennett Lake	Bennett Lake	Albert	earth & timber crib	4.0	timber chute	Active
86	BV26	Point Wolfe R.	Point Wolfe River	Albert	timber crib	10.4	broad-crestedweir	Active
87	BV28	Fenton Pond	Fenton Lake	Albert	earth	1.0	conc. chute	Active
88	BV29	-	Forty-Five River	Albert	-	-	-	Breached
89	BV30	Shepody River Tidal	Shepody River	Albert	earth	3.0	conc. chute	Active
90	BV31	-	Shepody River	Albert	earth	4.5	drop inlet	Active
91	BV32	-	Shepody River	Albert	earth	-	drop inlet	Active
92	BV33	Square Lake	Square Lake	Albert	earth&rock	5.0	conc. chute	Active
93	BV34	-	Crooked Creek	Albert	earth	3.0	metal pipes	Active
94	BV42	-	Lake Brook	Albert	-	-	-	-
95	BV43	Forty-Five River	Forty-Five River	Albert	-	-	-	-
96	BV44	-	Forty-Five River	Albert	-	-	-	Breached
97	BV47	-	Unnamed	Albert	earth	5.0	timber aboideau	Active
98	BV48	-	Unnamed	Albert	-	-	-	Active
99	BV49	-	New Horton Creek	Albert	earth	2.0	drop inlet	Active
100	BV50	-	New Horton Creek	Albert	earth	1.2	aboideau	Active
101	BV51	-	New Horton Creek	Albert	earth	2.0	drop inlet	Active
102	BV52	-	Unnamed	Albert	earth	3.0	-	Breached
103	BV63	McFadden Lake	McFadden Lake	Albert	earth	1.0	conc. chute	Active
104	BV64	-	Newfoundland Creek	Albert	earth	3.0	drop inlet	Active
105	BV65	Albert Reservoir	Crooked Creek	Albert	concrete& earch	1.8	broad-crestedweir	Active

end of the range. The Mississippian also exhibits more higher-yield wells, in the 0.6-1.5 l/sec range, than does the Precambrian.

Pennsylvanian complex: Well depth and yield characteristics throughout much of the Pennsylvanian complex are markedly different from those of the pre-Pennsylvanian rocks. This is particularly evident in the northern portion of Kent County. Depths and yields in upland areas are compared to those in adjacent coastal areas.

The graphs in Figure 'C' depict depth and yield statistics for Pennsylvanian rocks in the upland area from Rogersville to Harcourt. Overall, wells in this area are the shallowest of any area examined in the planning region, with the modal depth range being 10 - 13 m and 85% of the wells being 25 m or less in depth. Only one well in the group of 58 was greater than 40 m deep. Out of the 45 wells for which yields were recorded, none yielded less than 0.3 l/sec, and 92% of the wells yielded between 0.4 and 0.8 l/sec. In this area and throughout most of the Pennsylvanian complex, there is very little cause for concern about getting an inadequate water volume to operate a household.

Well depths in the Pennsylvanian rocks of the Pointe Sapin-Rexton coastal area are very similar to those in the adjacent Rogersville upland, with the mode in the depth distribution occurring in the 13-16 m range, and 78% of all wells being 25 m or less in depth (Figure D). Well yields are generally higher than in the inland area and much higher than in the pre-Pennsylvanian units, with 81% of wells yielding between 0.6 and 1.5 l/sec. Again, none of the documented wells yield less than 0.3 l/sec.

In the Harcourt-North Branch Canaan River upland area, wells are noticeably deeper than in the Rogersville upland. The bimodal depth distribution has 40% of the wells in one group between 13 and 21 m depth and 28% in another distince group between 30 and 50 m depth (Figure E). A few deep wells are evident, with 6% of wells being greater than 55m deep, and a maximum depth of 110 m. The tendency towards deeper wells in this area might be a function of the proximity of pre-Pennsylvanian basement rocks in the sub-surface, or simply of specific aquifer properties of the local facies of the Pennsylvanian complex. There is a strong peak in yield frequency at 0.4 l/sec and 45% of all the wells documented in the area yield 0.4 or 0.45 l/sec. There are conspicuously fewer wells with yields greater than 0.45 l/sec than in the Rogersville upland and substantially more low-yield wells.

The statistical distribution of well depths in the Ste. Anne de Kent - Cocagne coastal block is similar to that of the adjacent coastal area of Pointe Sapin-Rexton, to the north. Wells up to 25 m in depth account for 76% of the total (Figure F), although there are more wells in the deeper end of this range than are evident in Point Sapin - Rexton. The distribution of well yields is also basically similar between the two areas, although Ste-Anne de Kent - Cocagne has a concentration of wells in the 0.4 l/sec clasification that is not evident in the northern coastal zone. Wells yielding between 0.8 and 1.5 l/sec account for 63% of the total.

In the Scoudouc-Midgic-Upper Sackville upland area (Figure G), well depths are generally similar to those in the Harcourt-North Branch Canaan area, with the great majority being between 15 and 45 m in depth. Within this range, though, the distribution is more regular, rather than being bimodal as in the Harcourt-North Branch Canaan area. Well yields are a little lower than in the Harcourt-Canaan area. Well yields are a little lower than in the Harcourt-Canaan upland, and substantially lower than in the Rogersville upland, with 63% of the wells yielding between 0.15 and 0.4 l/sec. The yields are, however, still adequate to supply individual domestic systems in nearly all cases.

The Pennsylvanian rocks of the Robichaud-Little Shemogue (Figure H), coastal zone have a normal unimodal depth distribution with a well defined mode in the 15-20 m depth class and 84% of the wells having depths of 30 m or less. Depth characteristics of wells in all three coastal zones of the Pennsylvanian are very similar. Yield statistics are fiarly similar to those in the Ste. Anne de Kent - Cocagne coastal zone, with most wells yielding 0.4 l/sec or more. There are slightly more low yields and somewhat fewer high yields in this segment of the coastal area than in those to the north. In general it appears that in the coastal zones, well depths are moderately shallower and yields are significantly greater, than in the inland zones.

Statistics on the Pennsylvanian rocks of the Petitcodiac-Turtle Creek-Elgin area, lying between the limbs of the Caledonia Highlands, indicate a well depth distribution (Figure I) reminiscent of that in the Mississippian unit (Figure B), with a relatively deep modal classification in the 30-35 m range. Among the other areas of the Pennsylvanian that were evaluated, the well depths most resemble those of the Scoudouc upland. Small areas in the Petitcodiac and Elgin vicinities probably include a few wells drilled in the Mississippian unit, and wells near the contact in these vicinities might penetrate the Mississippian in the subsurface. Well yields are generally good, with 71% yielding between 0.4 and 1.5 l/sec; expected yield is better than in either the Mississippian, or in the Pennsylvanian of the Scoudouc area.

Surficial deposits: It is probable that a substantial number of shallow dug wells are in existence in all parts of the planning region, although no statistics are available. A well dug in unconsolidated surficial deposits, which could be constructed without reliance on sophiscticated commercial well drilling equipment, we in the not too distant past frequently the most economical and logical form of water supply. In certain geological settings, dug wells may have relatively low yields, or be more sensitive to summer and winter drought conditions than are drilled wells, but these conditions did not so seriously affect households in the past that were not so dependent as we are today on appliances that use large volumes of water. In areas where the deeper groundwater is of good quality, it is now common to see old dug wells being replaced by drilled wells.

In contrast to this trend, it has been noted in limited areas that the use of dug wells and springs as individual water supplies continues to be very common. In the area around St. Joseph in Dorchester Parish, it has been estimated that about 40-50% of rural individual water supplies come from springs or shallow wells dug in the sandy to loamy glacial till. The Village of St. Joseph itself derives part of its supply from springs. It is fairly common in this area to find springs that yield at least 0.4 l/sec and supply water for several families, and two of the St. Joseph Village springs have seasonal maximum yields of about 2.0 l/sec. The rather heavy local reliance on groundwater from overburden is mainly a result of poor ground water quality in the Missisiippian and Mississippian-to-Pennsylvanian rock units of the area.

It is likely that wells dug in glacial till throughout most of the planning region would yield a marginally sufficient volume of water for domestic purposes, and the storage volume or a large diameter dug well would cushion the effects of peak-use periods against relatively low instantaneous yields. Wells dug in the less compact ablation till units would likely on average have better yields than those developed in lodgement till. Any gravel or sand deposits that have a water table at shallow enough depth to be penetrated by a dug well should yield relatively large volumes of water, but such deposits are very localized. The area of ancient marine deposits that flanks the Northumberland Strait coast, ina areas where it is composed of sandy or gravelly materials as opposed to clay, would probably be locally suitable for the development of dug wells, as a shallow water table should be quite common.

No major supplies in the planning region are obtained from high yield, screened gravel wells.

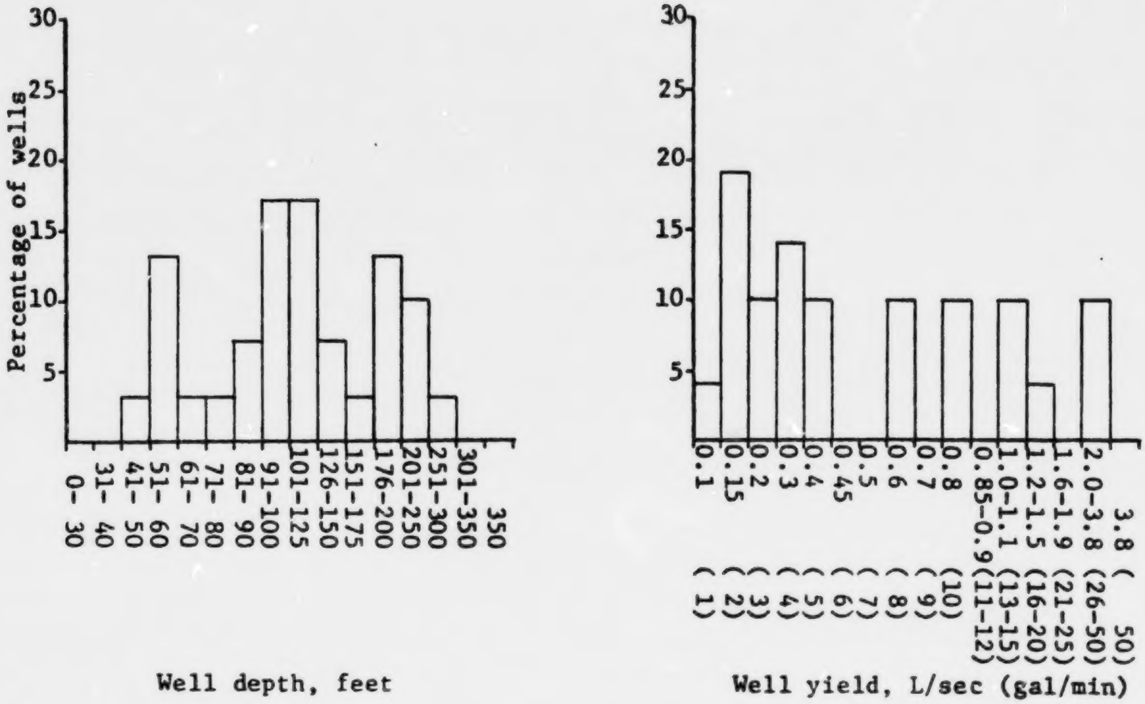


Figure A: Mainly Precambrian; Elgin, Alma, W. to Rockville

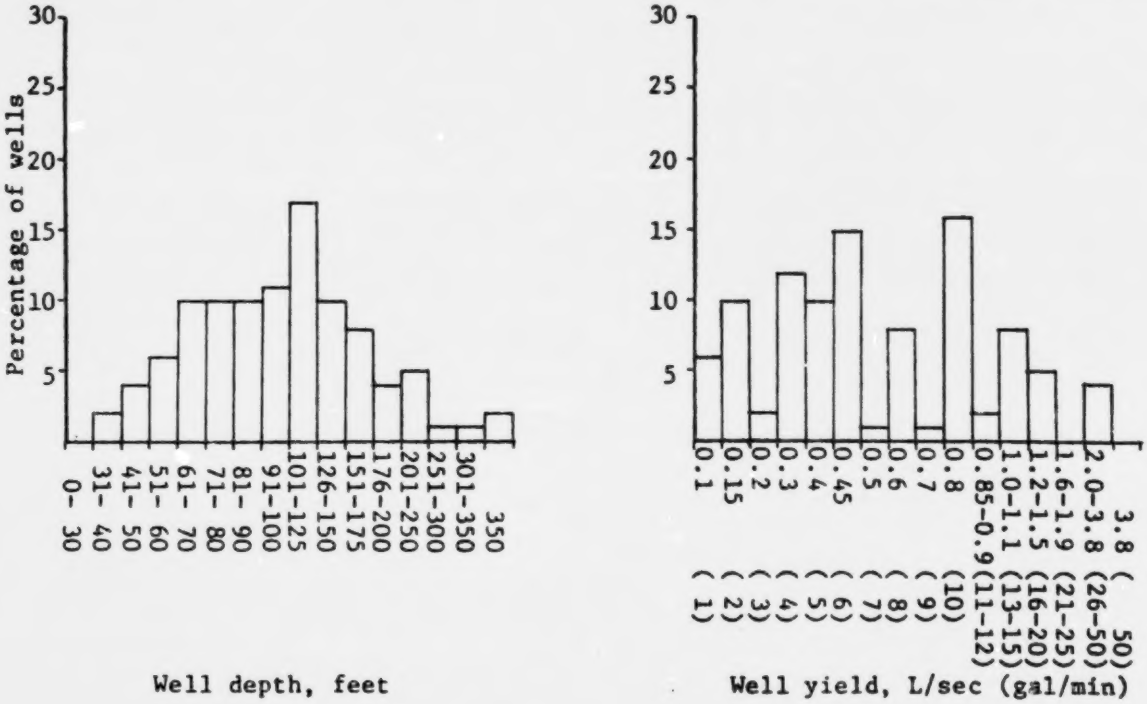


Figure B: Mississippian rocks: Cornhill-Havelock-Lewis Mountain

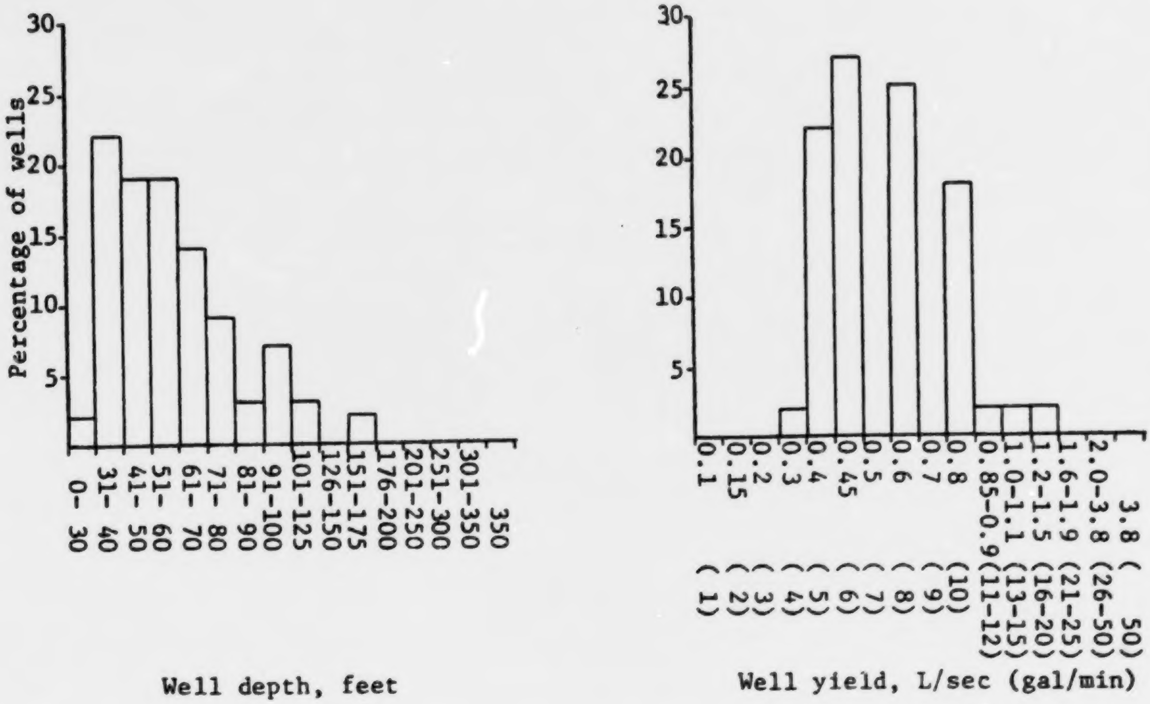


Figure C: Pennsylvanian rocks, upland; Rogersville-Harcourt

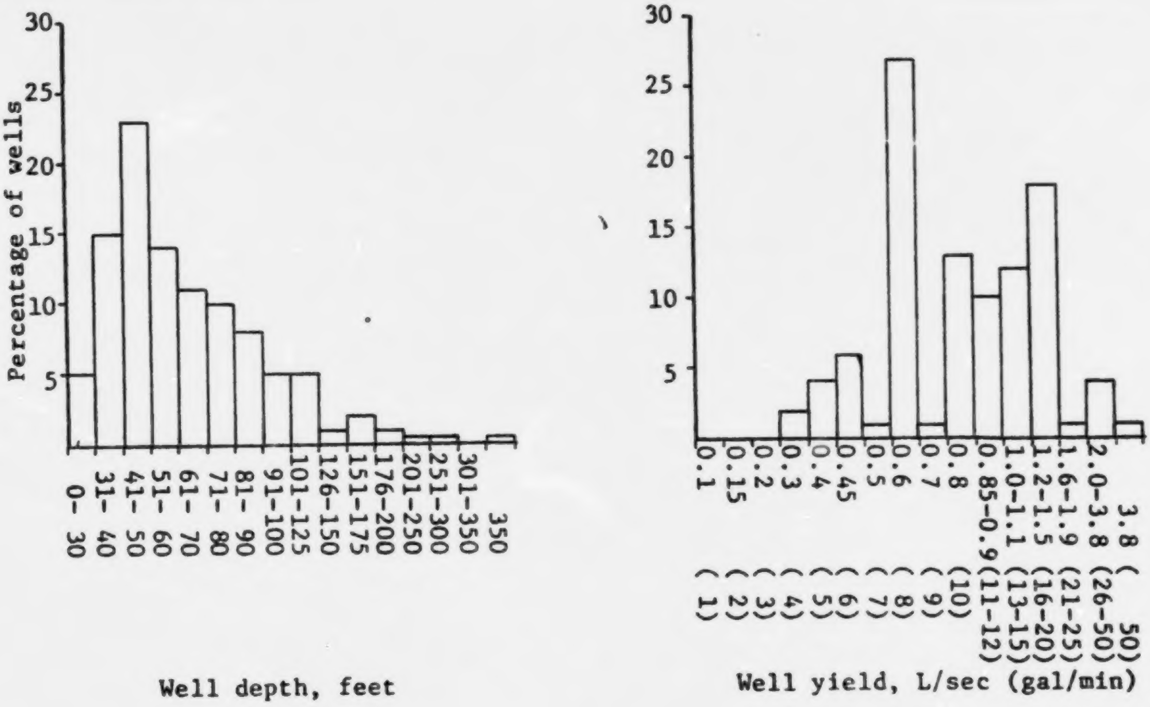


Figure D: Pennsylvanian rocks, coastal; Pointe Sapin-Rexton

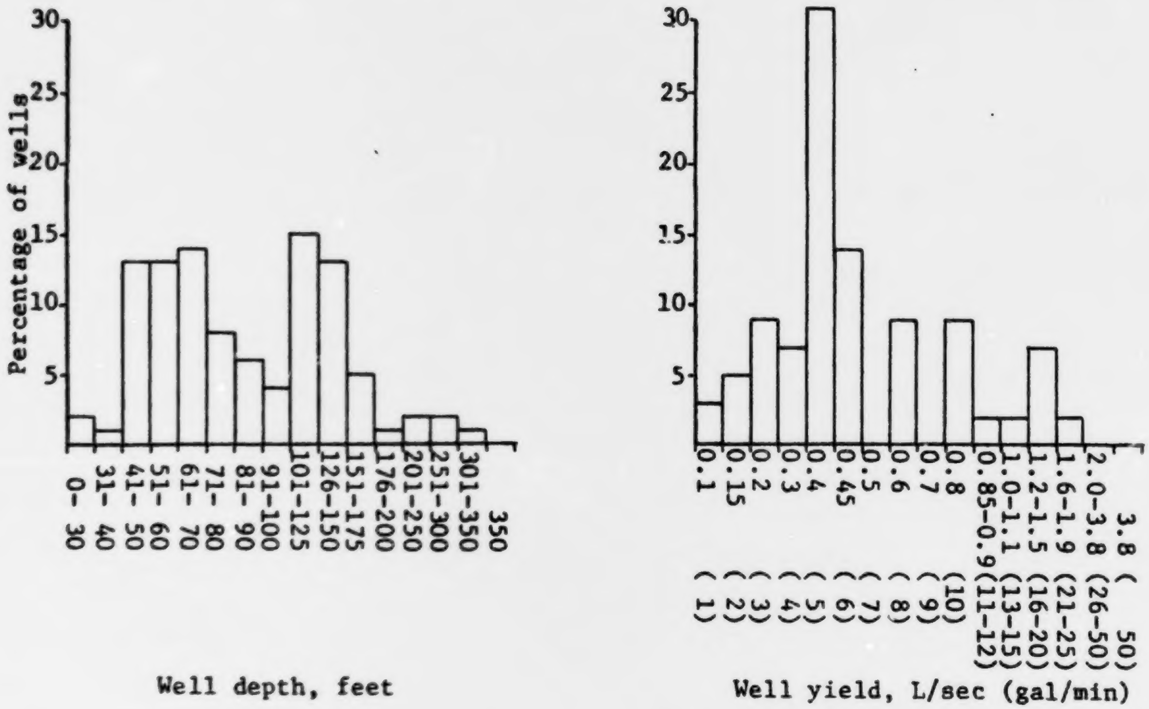


Figure E: Pennsylvanian rocks, upland; Harcourt-N. Branch Canaan River

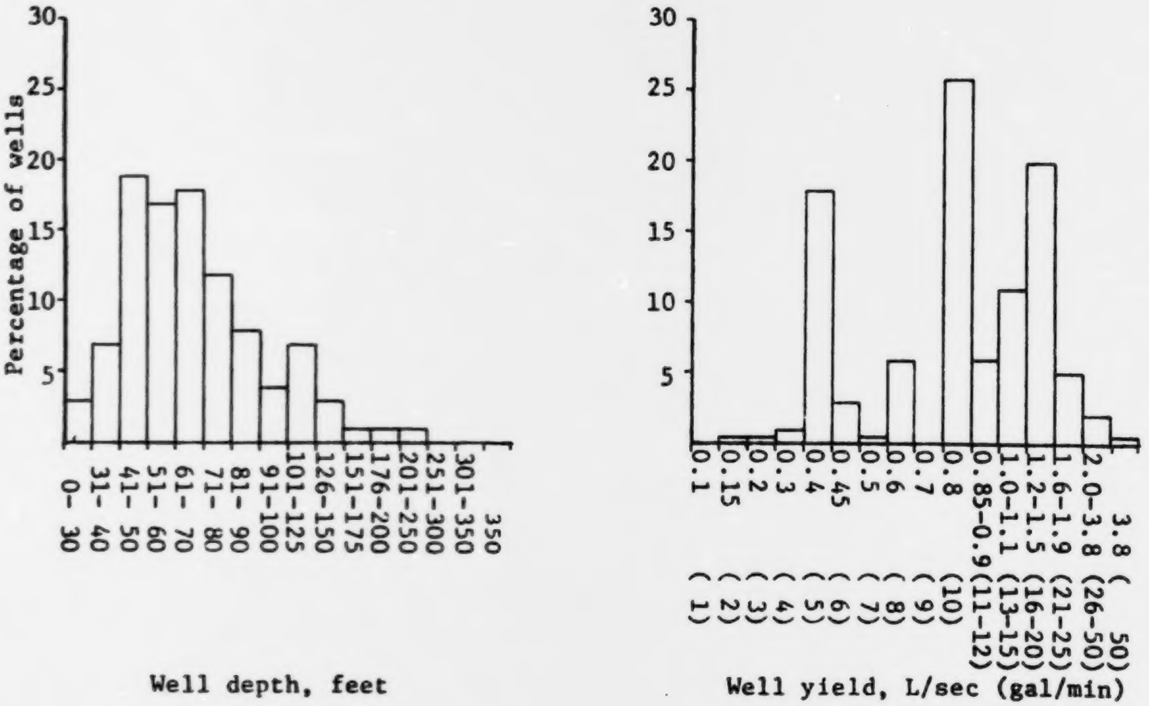


Figure F: Pennsylvanian rocks, coastal; Ste-Anne de Kent-Cocagne

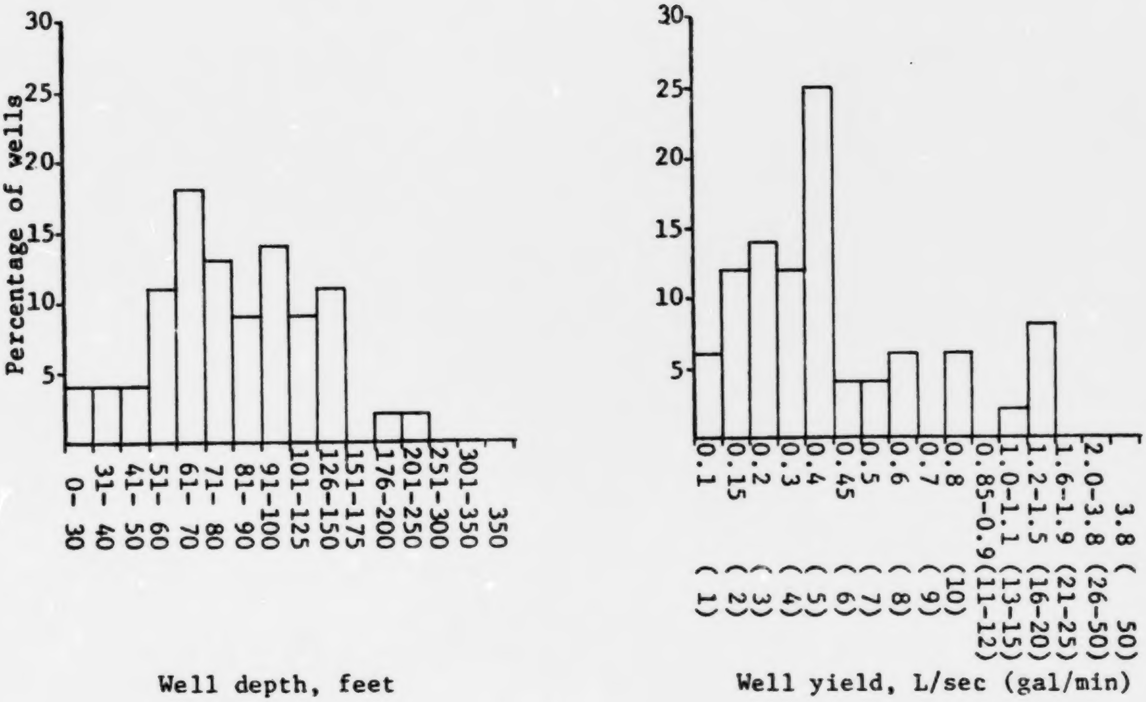


Figure G: Pennsylvanian rocks, upland; Scoudouc-Midgic-Upper Sackville

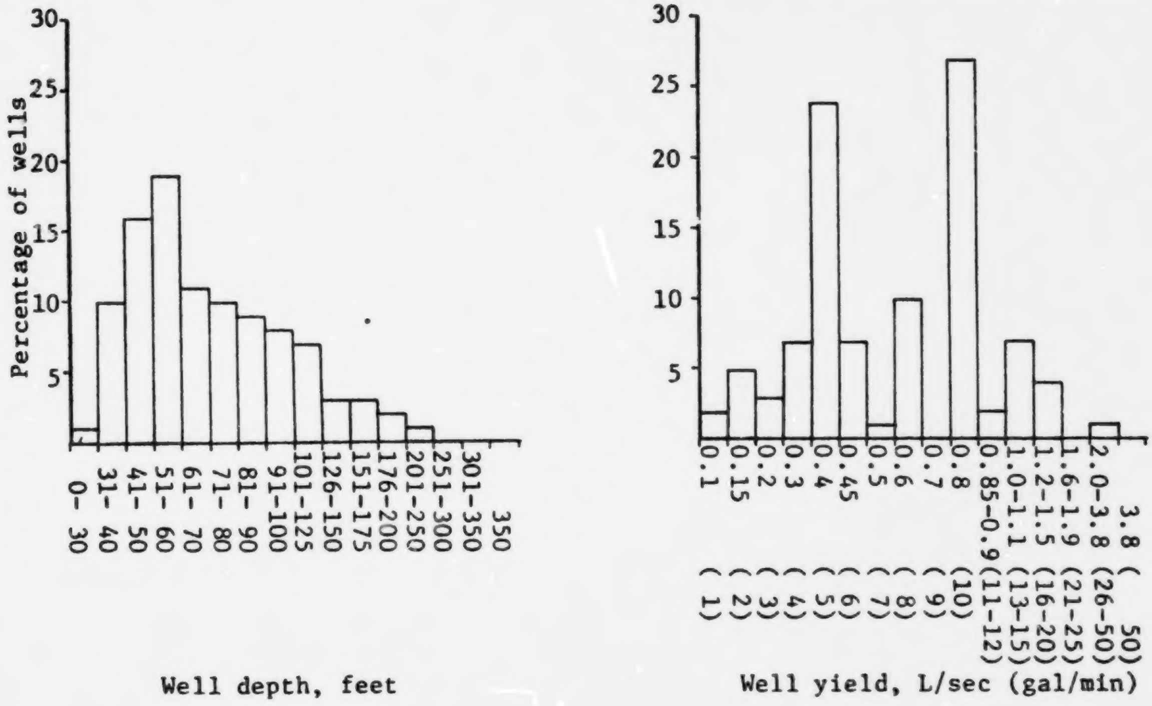


Figure H: Pennsylvanian rocks, coastal; Robichaud-Little Shemogue

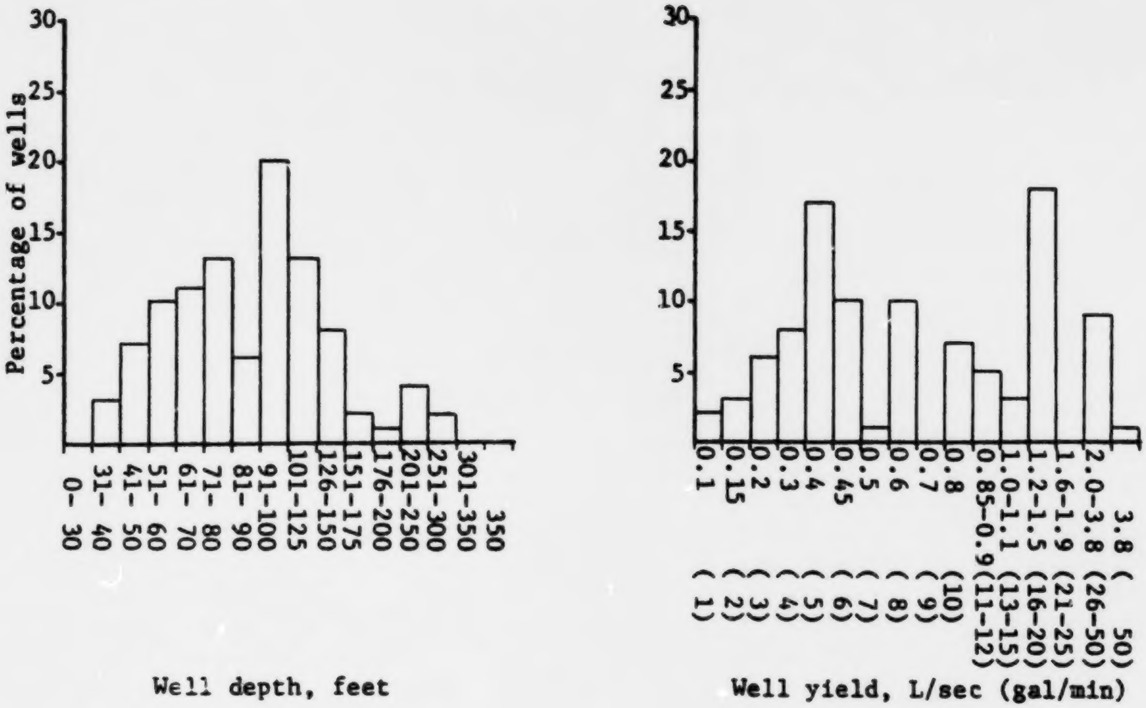


Figure I: Pennsylvanian rocks; Petitcodiac-Turtle Creek-Elgin

A simplified map indicating the available surface and groundwater resources in the planning region is shown in Figure (2.2). The surface water information was based on the available lowflow frequency analysis (20-year, 7-day duration lowflow) at various hydrometric stations. The available yield from a particular watercourse in litres per minute can be obtained by multiplying the area of the drainage basin in square kilometers by the number shown on the map. The groundwater information presented in this figure was based on the available well records within the region. This information indicates the approximate expected yield in litres per minute from wells drilled in various areas.

A larger "Water Availability Map", based on the above analysis, covering the entire province is available from the Water Resources Branch, New Brunswick Department of the Environment.

2.1.3 Water Quality

2.1.3.1 Surface Water Quality

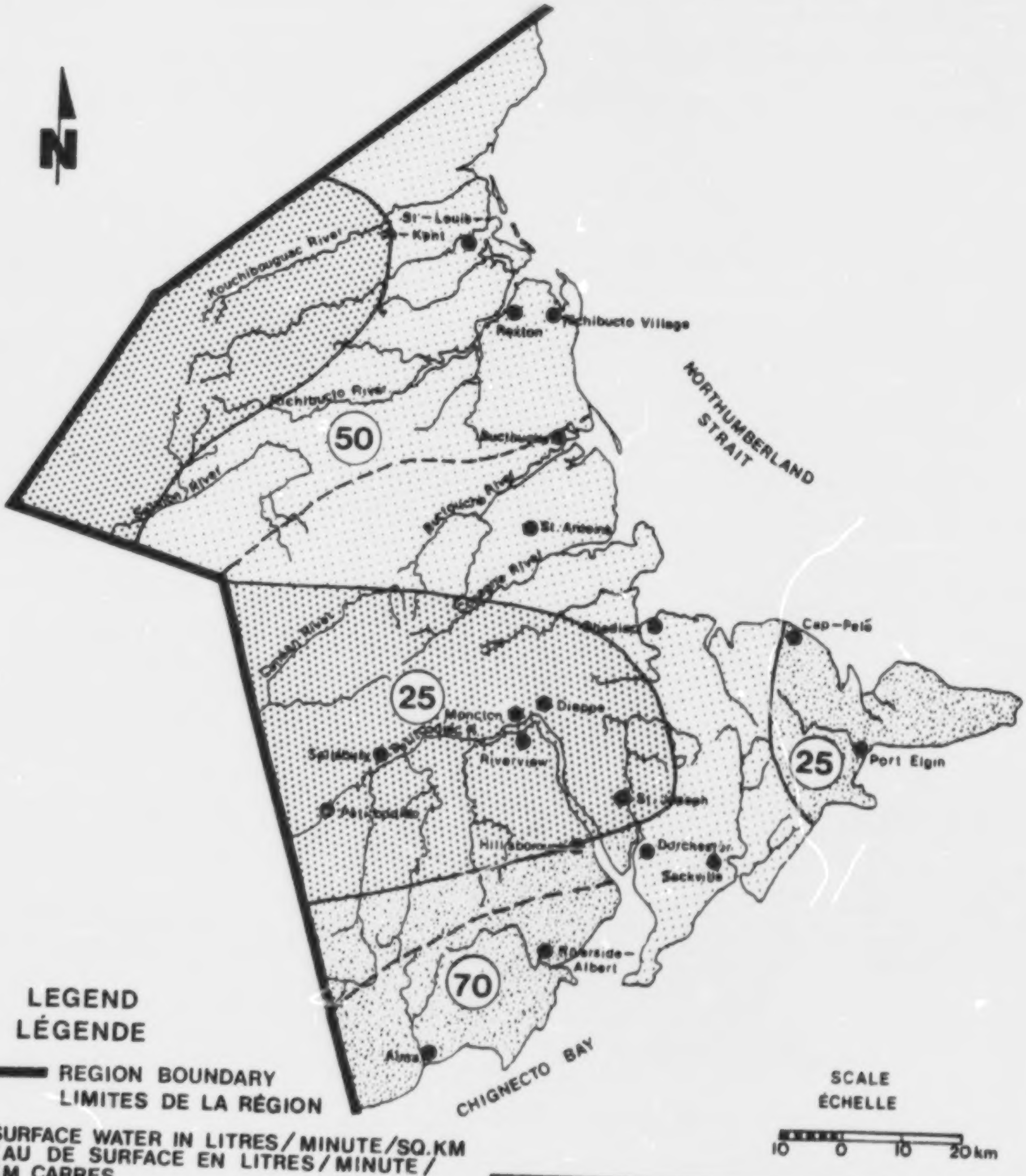
Surface water within the Moncton Planning Region consist of numerous streams and many small lakes. All of the lakes within the Moncton region together occupy only 15 km^2, 0.2% of the region's total area. The mose prominent lakes are located within the Sackville-Shediac area (drainage index subdivision, 1BT) and include Square Lake, Front Lake, Large Lake and Morice Lake. See Table (2.2) for list of lakes in this region. There are a number of dams of various sizes within this region. See Table (2.3) for list of dams in this region.

Water quality throughout the region varies from good to excellent in the upper reaches and headwaters of most of the prominent rivers and is degraded to the point of being unsightly and a health hazard in the lower section of the Petitcodiac River and its tributaries in the vicinity of the City of Moncton. The estuaries of some of the region's major rivers which flow into the Gulf of St. Lawrence and the Bay of Fundy exhibit a degree of pollution, which has necessitated the closing of these areas to shellfish harvesting.

PETITCODIAC RIVER: The most prominent watercourse within the Moncton Planning Region is the Petitcodiac River. Because of this river basin's high potential for industrial, agricultural and urban development and because urban development in the vicinity of Moncton has already downgraded that section of the Petitcodiac River and its adjacent tributaries, a survey was conducted between 1975 and 1979 by Environment New Brunswick with the purpose of providing baseline water quality information on the Petitcodiac watershed.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


N
St-Louis-de-Kent
Kouchibouguac River
Rexton
Richibucto Village
Richibucto River
NORTHUMBERLAND STRAIT
50
Buctouche
Salmon River
Buctouche River
St. Antoine
Cocagne River
Canaan River
Shediac
Cap-Pelé
25
Moncton
Dieppe
Salisbury
Petitcodiac R.
Riverview
25
Port Elgin
Petitcodiac
St. Joseph
Hillsborough
Dorchester
Sackville
Riverside-Albert
70
Alma
CHIGNECTO BAY
SCALE
ÉCHELLE
10
0
10
20 km

LEGEND
LÉGENDE

- ▬ REGION BOUNDARY
  LIMITES DE LA RÉGION
- (50) SURFACE WATER IN LITRES/MINUTE/SQ.KM
  EAU DE SURFACE EN LITRES/MINUTE/KM CARRES
- ▩ AVERAGE WELL YIELDS LESS THAN 50 LITRES/MINUTE
  PRODUCTION MOYENNE DE MOINS DE 50 LITRES/MINUTE
- ▨ AVERAGE WELL YIELDS 50 - 250 LITRES/MINUTE
  PRODUCTION MOYENNE DE 50 À 250 LITRES/MINUTE
- ░ AVERAGE WELL YIELDS GREATER THAN 250 LITRES/MINUTE
  PRODUCTION MOYENNE DE PLUS DE 250 LITRES/MINUTE

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

AVAILABLE WATER RESOURCES
RESSOURCES EN EAU DISPONIBLES

FIG. 2.2

The water quality through much of the Petitcodiac River Watershed varies from good to excellent and is considered suitable for swimming and for the support of a cold water fishery. Mixed farming and forestry activities occur in the upper portions of the Petitcodiac River Basin and the upstream sections of the North River show small concentrations of nutrients and organic matter. However, the effects of drainage resulting from farm activities appear minimal. Smaller tributaries, other than the Anaganse and Pollett Rivers, remain unsampled and localized problems may be undetected.

The most severe water quality problems in the Petitcodiac River Basin occur in the lower end of the watershed where settlement is most heavily concentrated. Dissolved oxygen levels decline and phosphates, organic matter and fecal coliform bacteria increase sharply. This is most likely due to a combination of a lack of sewage collection and treatment facilities in some areas, inadequate or improperly operated facilities in others, or the lack of sufficient assimilative capacity of receiving streams. A large portion of Moncton's sewage is discharged untreated to the estuary and it is probable that intrusion through the control gates at the causeway contributed further to the decline in water quality. The water at this point is considered unsuitable for most uses.

The quality of Jonathan Creek, Halls Creek and Humphrey Brook is degraded to the point of being unsightly and a health hazard. This is due primarily to discharge of treated and untreated domestic waste from Moncton and outlying areas. Additional and/or improved treatment or installation of a collection system which would divert waste away from these streams is needed if water quality is to be improved.

POLLETT RIVER: Water quality in the headwaters of the Pollett River is excellent. Water quality downstream is good despite a small loading of organics and nutrients. A slight increase in nutrients near Kay Settlement is caused by treated waste released at Jordon Memorial Sanitorium at River Glade.

COVERDALE RIVER: The Coverdale River receives very little waste because of the limited human activity in its headwaters. Near the mouth, bank erosion and agricultural activities are evident and this affects water quality to some degree. A slight elevation in phosphates as well as occasional high fecal coliform count may be a result from farmland runoff.

TURTLE CREEK: Water quality is excellent in most of Turtle Creek. High nutrient and coliform values, probably the result of agricultural activity, have been measured downstream of the reservoir.

JONATHAN CREEK: In the upstream areas, some degradation is indicated by elevated phosphate and fecal coliform levels. Until treatment is improved or waste is diverted away from the area, conditions cannot be expected to improve. The environment of the lower reaches of Jonathan Brook is somewhat degraded. High phosphate, carbon and fecal coliform levels in the lower portion of Jonathan Creek is attributed mainly to treated domestic waste discharge. In 1975, low heavy metal concentrations were indicated but limited sampling in 1979 suggested that zinc concentration in this section of the river is higher than the safe level for aquatic life as specified by the International Advisory Subcommittee on Water Quality in the Saint John River (1980). Further investigation is needed to verify this.

HALLS CREEK: This stream receives domestic waste throughout much of its length. Many subdivisions and the City of Moncton discharge their waste into the stream, and make it one of the most polluted watercourses in the Province. In downstream areas, phosphate and fecal coliform levels are extremely high and nitrogen and carbon are also elevated. Water quality is somewhat improved at upstream stations. There is a marked degradation of water quality at points between Mapleton Road and Université de Moncton. That portion of Halls Creek near the Université de Moncton is grossly organically polluted. In this condition, it must be considered a health hazard in addition to being unsightly.

HUMPHREY'S BROOK: Samples secured from this watercourse indicate poor water quality. The causes are similar to those described for Halls Creek.

FOX CREEK: Although only limited sampling has been done on Fox Creek, contamination is indicated. The major portion of the sewage is probably due to the presence of estuarine water which receives a heavy load of sewage from the City of Moncton

NORTHUMBERLAND COASTAL RIVERS: Water quality surveys of the estuaries of coastal rivers along the Northumberland Strait and Bay of Fundy are done regularly by Environment Canada. This is an area where the regional fishery is oriented almost exclusively toward shellfish species - the high valued lobster and scallops. Because of their ability to filter micro-organisms from water while feeding, shellfish can become a health hazard to human consumers. Thus, the water must be nearly free of micro-organisms. For an area to be open to harvesting, fecal coliform counts which are used to indicate the presence of pathogenic organisms, must have a median of no more than 14/100 ml and no more than 10 percent of the samples greater than 43/100 ml. With such strict requirements, small and seemingly insignificant sources of pollution can result in the closure of large areas of shellfish habitat.

Numerous areas in the Moncton Planning Region are closed to shellfish harvesting. These include: Cumberland Basin, Petitcodiac River and Shepody Bay, Baie Verte including Gaspereau River and Timber River, three areas on Shediac Bay, Western Barachois, Cocagne Harbour, Buctouche River, Little Buctouche River, Chockpish River, Richibucto River, Little Aldouane River and Kouchibouquacis River.

The analysis of nutrient levels, heavy metals concentration and the physical parameters of surface water within the Moncton Planning Region are summarized in Table (2.4), (2.5) and (2.6) respectively. The data presented in these tables are obtained at selected Provincial and Federal water quality stations in the planning region. Comprehensive lists of water quality stations within the region are presented in Appendix C.

The prevention of future water quality degradation requires adequate control and planning of future developments. In critical areas (e.g. Shediac beach area) this should include such measures as control of the location and density of cottage development, construction of suitable sewage system (i.e. Moncton) vegetative buffer strips along shore frontage, restrictions on the use of fertilizers, pesticides, etc. Likewise, the location and design of future industrial, agricultural and residential development and adequate treatment and disposal of wastes must be ensured if watercourses are to remain suitable for a wide range of uses. Since complete treatment of wastes prior to discharge is seldom achieved, it is essential to select a receiving water where the assimilative capacity will not be exceeded. Land use practices associated with agricultural and forestry operations have pronounced effects on water quality and should be conducted in such a way that the amount of contaminants reaching the streams is minimized.

TABLE (2.4) MEDIAN NUTRIENT LEVELS - MONCTON PLANNING REGION

Station	Watercourse	Total Organic Carbon (mg/l)	Total Kjeldahl Nitrogen (mg/l)	Nitrate Nitrite (mg/l)	Total Inorganic Phosphate (mg/l)	Total Phosphate (mg/l)
Provincial						
00BR01BU0007	Petitcodiac River	75.0	1.7	< .01	5.24	1.9
00BR01BU0008	Petitcodiac River	12.0	.5	.343	1.14	1.22
00BR01BU0009	Petitcodiac River	6.5	.3	.030	.023	.091
00BR01BU0010	Petitcodiac River	10.0	.27	< .01	< .03	.062
00BR01BU0011	Petitcodiac River	11.0	.35	.018	< .02	.092
00BR01BU0012	Petitcodiac River	10.0	.25	.022	< .02	.070
00BR01BU0013	Petitcodiac River	13.3	.32	< .01	< .03	.10
00BR01BU0014	Petitcodiac River	13.5	.24	.6	< .02	.046
00BR01BU0015	Pollett River	2.1	< .2	.03	< .02	.03
00BR01BU0016	Pollett River	7.0	.29	.089	< .03	< .02
00BR01BU0017	Pollett River	4.8	.20	.139	< .02	< .02
00BR01BU0018	Pollett River	6.0	.14	.17	< .03	< .02
00BR01BU0019	CoverDale River	4.0	.6	< .01	< .04	.04
00BR01BU0020	CoverDale River	3.0	.28	.035	.058	.086
00BR01BU0021	CoverDale River	5.0	.26	.031	< .02	< .02
00BR01BU0022	CoverDale River	5.0	.31	.035	< .02	< .02
00BR01BU0023	CoverDale River	5.0	.29	.040	< .02	< .02
00BR01BU0024	Turtle Creek	5.0	.23	.015	.133	.15
00BR01BU0025	Turtle Creek	3.0	.19	.11	< .02	.06
00BR01BU0026	Turtle Creek	2.0	.16	.041	.026	.037
00BR01BU0027	Jonathan Creek	11.0	.5	.22	.18	.30
00BR01BU0028	Jonathan Creek	9.0	.4	.17	.07	.10
00BR01BU0029	Halls Brook	9.8	1.9	.8	1.80	2.0
00BR01BU0030	Halls Brook	19.0	1.0	1.05	1.60	1.0
00BR01BU0031	Halls Brook	4.0	< .2	.28	.22	.27
00BR01BU0032	Halls Brook	8.0	.3	.42	.15	.16
00BR01BU0033	Halls Brook	4.0	.2	.3	< .09	.10
00BR01BU0034	Humphreys Brook	17.0	1.28	2.1	1.67	2.0

Source(s): (a) ENVIRONMENTAL SERVICES BRANCH, N.B. DEPARTMENT OF THE ENVIRONMENT
(b) ENVIRONMENT CANADA, I.W.D., WATER QUALITY BRANCH, WATER QUALITY DATA, N.B. 1961-1977, OTTAWA, 1979.

TABLE (2.4) Continued

Station	Watercourse	Total Organic Carbon (mg/1)	Total Kjeldahl Nitrogen (mg/1)	Nitrate Nitrite (mg/1)	Total Inorganic Phosphate (mg/1)	Total Phosphate (mg/1)
00BR01BU0035	Humphreys Brook	17.0	.12	.17	.06	.19
00BR01BU0036	Fox Creek	24.0	.96	3.24	2.29	2.57
00BR01BS0001	Coal Branch River	24.4	.5	.03	.06	.075
00BR01BS0002	Coal Branch River	15.8	.6	.02	.05	.06
00BR01BS0003	Coal Branch River	13.9		< .01	.04	.05
00BR01BS0005	Coal Branch River	12.5		< .01	.04	.06
00BR01BS0018	Coal Branch River	18.4		< .01	.05	.07
00BR01BS0019	Coal Branch River	15.6		< .01	.07	.1
00BR01BS0020	Trout Brook	15.2		.09	.2	.2
Federal						TOTAL* PHOSPHORUS
00NB01BS0001	Coal Branch River	7.5	< .5	.029	.018	.023
00NB01BS0016	Buctouche River	13.3		.023	.007	.015
00NB01BS0046	Richibucto River	10.2		.045	.005	.013
00NB01BR0001	Kouchibouguac R.	11.2	< .5	.020	.020	.025
00NB01BR0011	Kouchibouguac R.	7.5		.05	< .005	.016
00NB01BU0001	Palmers Creek	5.3		.089	.015	
00NB01BU0004	Petitcodiac River	6.8	.5	.095	.030	.045
00NB01BU0005	Petitcodiac River	4.5	.5	.100	.013	.020
00NB01BU0006	Turtle Creek	3.3		.06	.015	.007
00NB01BU0008	Memramcook River			.303	.025	
00NB01BU0031	Petitcodiac River	5.8		.010	.025	
00NB01BV0015	Point Wolf River	3.9		.480	.005	.005
00NB01AN0001	Salmon River	9.1		< .01	.018	.010

*NOTE: PARAMETER MEASURED AT FEDERAL STATIONS IS 1/3(PO_4)

TABLE (2.5) MEDIAN HEAVY METALS CONC. - MONCTON PLANNING REGION

Station	Watercourse	Cadmium (mg/l)	Copper (mg/l)	Iron (mg/l)	Lead (mg/l)	Mercury (mg/l)	Zinc (mg/l)
PROVINCIAL							
00BR01BU0007	Petitcodiac River	<.01	.02		<.1	.0001	.05
00BR01BU0008	Petitcodiac River						
00BR01BU0009	Petitcodiac River						
00BR01BU0010	Petitcodiac River						
00BR01BU0011	Petitcodiac River						
00BR01BU0012	Petitcodiac River						
00BR01BU0013	Petitcodiac River	<.01	<.01	-	<.1	<.0001	.09
00BR01BU0014	Petitcodiac River	<.01	<.01	-	<.1	<.0001	.04
00BR01BU0015	Pollett River	<.01	<.01	-	<.1	<.0001	.04
00BR01BU0016	Pollett River						
00BR01BU0017	Pollett River						
00BR01BU0018	Pollett River						
00BR01BU0019	Pollett River	<.01	<.01		<.1	<.0001	.04
00BR01BU0027	Jonathan Creek	<.01	.01		<.1	<.0001	.04
00BR01BU0028	Jonathan Creek	<.01	<.01		<.1	<.0001	.06
00BR01BU0030	Halls Brook	<.01	.06		<.1	<.0001	.12
00BR01BS0001	Coal Branch River	<.01	<.01		<.1	<.0005	<.01
00BR01BS0002	Coal Branch River	<.01			<		
00BR01BS0003	Coal Branch River	<.01	<.01				
00BR01BS0005	Coal Branch River	<.01	<.01		<.1	<.0005	<.01
00BR01BS0018	Coal Branch River	<.01	<.01		<.1	<.0005	<.01
00BR01BS0019	Coal Branch River	<.01	<.01		<.1	<.0005	<.01
00BR01BS0020	Trout Brook	<.01	<.01		<.1	<.0005	<.01

TABLE (2.5) Continued

Station	Watercourse	Cadmium (mg/1)	Copper (mg/1)	Iron (mg/1)	Lead (mg/1)	Mercury (mg/1)	Zinc (mg/1)
FEDERAL							
00NB01BS0018	Buctouche River	<.001	.009	.330	.002	.14	.01
00NB01BS0001	Coal Branch River	<.001	<.002		<.002	.05	.002
00NB01BR0001	Kouchibouguac River	<.001	.008	.280	.002	.17	.01
00NB01BS0011	Kouchibouguac River						
00NB01BU0008	Memramcook River	<.001	.006	.390	.003		<.01
00NB01BU0001	Palmers Creek	<.001	.007	.265	.002	.17	.011
00NB01BU0004	Petitcodiac River	<.001	<.002		.004	<.05	.009
00NB01BU0005	Petitcodiac River	<.001	.02	.170	.006	.13	.013
00NB01BU0031	Petitcodiac River	<.001	<.001	.340	.002	.17	.009
00NB01BU0006	Turtle Creek	<.001	.002	.110	<.002	<.05	.008
00NB01BU0015	Point Wolfe River	<.001	<.001	.005	.002	<.05	.005
00NB01BS0046	Richibucto River						
00NB01AN0001	Salmon River	<.001	.002	.240	.002	<.05	.007

SOURCES: (a) ENVIRONMENTAL SERVICES BRANCH, N.B. DEPARTMENT OF THE ENVIRONMENT
(b) ENVIRONMENT CANADA, I.W.D.

TABLE (2.6) PHYSICAL PARAMETERS - MONCTON PLANNING REGION

Station	Watercourse	Total Hardness	Suspended Solids	pH	Dissolved Oxygen (mg/1)	Specific Conductance (us/cm)	Chlorophyll (mg/1)	Secchi Depth (m)	Fecal Coliform Number/100 ml
PROVINCIAL									
00BR01BU0007	Petitcodiac River	122		6.7	8.0	1770			3005
00BR01BU0008	Petitcodiac River	1240		7.3	9.0	360			750
00BR01BU0009	Petitcodiac River	40		7.4	10.0	180			24
00BR01BU0010	Petitcodiac River	88		7.1		346			
00BR01BU0011	Petitcodiac River	84		7.3		325			
00BR01BU0012	Petitcodiac River	134		7.3		496			
00BR01BU0013	Petitcodiac River	100		7.0		188			58
00BR01BU0014	Petitcodiac River	74		7.1	9.0	180			40
00BR01BU0015	Pollet River	18.4		7.3	10.0	44			27
01BR01BU0016	Pollet River	13.0		6.8		37			77
01BR01BU0017	Pollet River	11.0		6.8		43			91
01BR01BU0018	Pollet River	10.0		6.4		25			31
01BR01BU0019	CoverDale River	20.8		7.3		37			78
01BR01BU0020	CoverDale River	12.0		6.9		28			
01BR01BU0021	CoverDale River	12.0		7.2		28			
01BR01BU0022	CoverDale River	11.5		7.0		26			
01BR01BU0023	CoverDale River	10.5		6.9		24			
01BR01BU0024	Turtle Creek	11.0		7.0		28			390
01BR01BU0025	Turtle Creek	11.5		6.9	12.0	28			50
01BR01BU0026	Turtle Creek	12.0		7.0	10.0	26			30
01BR01BU0027	Jonathan Creek	53.0		7.0	10.0	160			760
01BR01BU0028	Jonathan Creek	59.0		7.0	10.0	120			190
01BR01BU0029	Halls Brook	1280.0		6.8		1141			
01BR01BU0030	Halls Brook	67.8		6.8	8.0	200			25,300
01BR01BU0031	Halls Brook	47.0		7.2	8.0	183			170
01BR01BU0032	Halls Brook	82.0		7.2	10.0	172			200
01BR01BU0033	Halls Brook	44.0		7.3	10.	183			310
01BR01BU0034	Humphreys Brook	661		7.0		7526			
01BR01BU0035	Humphreys Brook	48		7.1	9.0	79			
01BR01BU0036	Fox Creek	64		6.8	7.0	539			15,500

TABLE (2.6) Continued

Station	Watercourse	Total Hardness	Suspended Solids	pH	Dissolved Oxygen (mg/1)	Specific Conductance (us/cm)	Chlorophyll (mg/1)	Secchi Depth (m)	Fecal Coliform Number/100 ml
00BR01BS0001	Coal Branch River	41		6.5		210			
00BR01BS0002	Coal Branch River	19		6.8		62			
00BR01BS0003	Coal Branch River	21.5		7.0		66.5			
00BR01BS0005	Coal Branch River	22.0		6.9		65			
00BR01BS0018	Coal Branch River	18.		6.6		50.5			
00BR01BS0019	Coal Branch River	10.5		6.5		29.5			
00BR01BS0020	Trout Brook	19.0		6.5		58.0			
Federal									
00NB01BS0001	Coal Branch	22.4		6.7	12.2	76.			
00NB01BS0018	Buctouche River	17.1		6.7	12.0	46.			
00NB01BS0046	Richibucto River	18.3		6.5	12.2	49.			
00NB01BR0001	Kouchibouguac R.	20.4		6.8	12.2	47.			
00NB01BR0011	Kouchibouguac R.	24.1		6.7	10.8	62.			
00NB01BU0001	Palmer's Creek	12.6		6.5	13.2	53.			
00NB01BU0004	Petitcodiac River	27.5		7.0	12.0	117.			
00NB01BU0005	Petitcodiac River	31.8		7.0	13.2	121.			
00NB01BU0006	Turtle Creek	16.8		7.0	11.9	47.			
00NB01BU0008	Memramcook River	11.2		5.9		46.			
00NB01BU0031	Petitcodiac River	59.8		7.0		247.			
00NB01BV0015	Point Wolf River	10.5		6.8	12.6	35.			
00NB01AN0001	Salmon River	11.8		6.2	12.1	37.			

SOURCE: (a) ENVIRONMENTAL SERVICES BRANCH, N.B. DEPARTMENT OF THE ENVIRONMENT.
(b) ENVIRONMENT CANADA, I.W.D., WATER QUALITY BRANCH, WATER QUALITY DATA - N.B., 1961-1977, OTTAWA, 1979.

2.1.3.2 Groundwater Quality

Evolution of Chemical Characteristics:

Groundwater begins its life as precipitation, infiltrating the ground surface during rain events and as a result of snowmelt. The waters of precipitation are normally very pure, and are characterized by very low concentrations of dissolved solids and usually a relatively low pH. Newly-recharged groundwater starts off with these characteristics, but quickly undergoes chemical changes that are dependent on the type of material it is flowing through, the distance of travel, and the residence time in the ground.

Groundwaters in the Moncton Planning Region are generaly of fair to excellent quality. Wells constructed in the Mississippian and Pennsylvanian rock units typically produce one of two types of water. Wells of moderate depth with relatively short casing are supplied mainly by water from the shallow fractured rock zone, most of which is fairly recently recharged into the ground. Dug wells in overburden also generally produce 'young' water. The slightly acid recharge water quickly begins dissolving calcium carbonate, iron and manganese, which are present in the cementing agents of the rock throughout most of the planning region and also in the overburden. Thus, the shallow groundwaters in both the overburden and the shallow, fractured bedrock, frequently have an elevated content of dissolved iron and manganese, and moderate to high hardness as a result of the calcium carbonate in solution. The pH is elevated to a near-neutral state with the solution of carbonate. This shallow groundwater type is classified as a calcium bicarbonate water.

The second major water type is encountered by wells that draw all or most of their water from a relatively great depth, and is most noticeable in wells with fairly deep casing that excludes direct inflow of the shallow groundwater. Bedrock wells cased to 30 m or greater frequently yield this water type, particularly in the flat-lying Pennsylvanian strata in instances where casing is seated in or penetrates the first shale or mudstone aquitard layer. During percolation to this greater depth, the water is apparently subjected to a natural base-exchange softening process whereby it takes on sodium ions from the formation and leaves calcium ions in their place. The result is a water of much decreased hardness, but frequently moderately elevated sodium content, that can be classified as a sodium bicarbonate water, or in the early phase of the transition as sodium-calcium bicarbonate water. At the same time, chloride content is low. As establishment of the sodium bicarbonate characteristic proceeds, pH increases and may reach a level of 9 or greater in water exclusively from deep zones. The now-basic pH evidently causes precipitation of dissolved iron and manganese, which are typified by relatively low concentrations in this water.

It should be noted that, while these basic water types are recognized as stages in the chemical evolution of the groundwater, it is common to find water with a composition anywhere in the transition system from precipitation water to the sodium bicarbonate type.

Because of limited habitation, rather few wells are drilled in the pre-Mississippian rocks of the Highland core, so that there is no readily available information on groundwater quality. In areas of intrusive rocks, there would likely be very little buffering capacity towards the acidity of precipitation water, so that a prevalence of acidic groundwater is a possibility, likely with relatively low hardness.

Specific Quality Problems:

Iron and manganese-

The occurrence of dissolved iron and manganese is commonplace in the shallow fractured rock zone that is tapped as a water supply by a large percentage of wells throughout the area. The severity of the contamination at any particular location is unpredictable. Certain approaches might have some success in avoiding this problem. Developing very recently recharged water from very shallow bedrock or overburden wells may result in low iron--manganese concentration, but may also give low pH and associated corrosiveness. In addition, shallow wells may have a seasonally unreliable water yield. If metal-laden water is encountered in a fracture at moderate depth, it may be possible to intersect another fracture at greater depth, yielding water that has been resident in the rock for a longer time and is in the transition to the sodium bicarbonate characteristic. The shallower water could be cased off, or the two waters could be allowed to mix to achieve acceptable chemistry. Incremental yields are fairly common in the repetitions sequences of the flat-lying Pennsylvanian rocks, so this approach might be successful in this unit. Drilling and casing both cost money, however, and the results are by no means guaranteed. The possibility also exists of encountering other chemical problems at depth, such as elevated sodium from either the sodium bicarbonate water or from saltwater intrusion in coastal areas, or fluoride, which is localized but probably more common in deeper waters.

Iron and manganese can be conditioned out of water with commercially available equipment. Moderate concentrations of the metals in combination with excess hardness can reportedly be removed by water softeners. For higher concentrations of the metals, manganese greensand treatment units can be effective. The pH of the water is critical to these forms of treatment, with low pH (acidity) causing rapid loss of conditioning capacity. If conditions are right, treatment can be the most economical and most certain solution to the problem. Iron and manganese are regarded only as an aesthetic problem, causing staining of plumbing fixtures and laundry, rather than as a health problem.

Hardness -

As with iron and manganese, excessive hardness of groundwater is widespread in the region, and occurs because of solution of cementing agents from the rock. Hardness is again primarily an aesthetic problem, capable of causing encrustations in cooking utensils and some pipes, and forming an insoluble curd when exposed to soap. Hardness can be treated with water softeners, which exchange sodium ions for the calcium ions that are mainly responsible for the hardness. The softening process causes some elevation of dissolved sodium, which may be of concern in certain cases. If hardness is not excessively high and is not causing great inconvenience, the simplest and certainly the cheapest solution is to accept the condition and forget it. There is evidence that hardness up to at least 200 mg/l is easily tolerated by most people.

Fluoride -

Fluoride is known to occur in concentrations up to a few milligrams per litre in well waters east and south of Moncton, particulary in the area of Dieppe and Lakeburn. The problem has also been detected in the Sackville area. It is most common in deeper wells, and may originate from igneous intrusive rocks in the subsurface below the depths usually penetrated by wells. Fluoride may have undesirable effects on teeth and bones, especially in children, at concentrations above 1.5 mg/l. Such high concentrations are relatively uncommon. At concentrations up to about 1 mg/l, fluoride in water is apparently beneficial to tooth structure. Small quantities of water for drinking purposes can be purged of fluoride by using a reverse-osmosis filter unit. Problems with operating these units are experienced where the water contains elevated concentrations of iron or manganese.

Saltwater Intrusion -

This problem is fairly common in coastal areas, where salt water from the sea extends inland as a wedge beneath the fresh groundwater in the shallow zone. Salt water may be induced into a well by excessive pumping of the well, or by development of too many wells in a limited area near the shore. Deep wells are more likely to be affected than are shallow ones. Decreasing the rate of water withdrawal may arrest the problem in certain cases; however, this type of contamination is persistent, and frequently tends to worsen with continued pumping. Relocating wells farther inland can solve or at least delay development of the problem. The preventive approach is most effective against saltwater intrusion, and it is advised that individuals avoid building habitations and drilling wells in already crowded near coastal locations, that wells be drilled relatively shallow and as far inland as possible under these conditions, and that building close to any large coastal groundwater users such as fish processing plants be avoided. On the contrary, new development of such large groundwater-using industries should be located well away from existing areas of habitation.

Road Salt -

It is not uncommon for water wells to become contaminated by the spreading and storage of ice-control salt for roads. Road crews are urged to use restraint in the amount of salt used in ice-control, especially in populated areas. Storage piles for salt and for pickled sand should always be covered, as large volumes of saline leachate are generated when these piles are exposed to precipitation. Salt storage yards should be located downslope of and adequately distant from any dwellings, so that water wells do not intersect any leachate plume that might develop.

Petroleum Contamination -

Contamination of groundwater by leaked or spilled petroleum products is a common problem. Underground steel tanks at service stations and other storage locations are subject to corrosion as their age increases, and leakage eventually results. Leaks from joints in underground delivery lines are also significant, and this problem applies even to new installations if sufficient care has not been taken to assure tight joints. Surface spillage, especially during transfer of large volumes of fuel products from tank trucks, occasionally results in massive contaminations. Underground leaks can persist for long periods of time without being detected, so that even at low leakage rates, it is not uncommon for thousands of litres of product to be lost. Petroleum contamination of groundwater persists for many years, even after the source is removed, and frequently results in permanent loss of the water supply.

The other major source of petroleum contaminated wells is domestic heating oil. Domestic oil tanks are poorly protected against corrosion, and in some cases rust through within 15 years or less, especially when located outdoors. Tanks should be replaced at or before this age. Owners should frequently check the condition of tanks, and of the oil delivery line and joints of the line. The oil filter housing should be checked for leakage, especially after a filter change. Lines should be routed so they will not be hit by power equipment such as lawn mowers and snow plows, and so that ice cannot fall on them from the roof. Tanks should be similarly positioned out of harm's way, and should be supported on a steady base so they cannot tip over. If spillage of a significant amount of petroleum product ever occurs on a property with an individual water supply, the owner should immediately remove the contaminated soil and properly dispose of it, even at the expense of hiring a backhoe and dumptruck. Negligent individuals are legally responsible for the contamination of neighbor's water supplies.

Locally, there are a few suspected cases of well contamination by naturally-occurring crude oil from the bedrock itself. This problem has been described in association with the Mississippian rocks in the St. Joseph area, and there are persistent stories of similar occurrences around Hillsborough, where oil and natural gas are produced from the Mississippian rocks of the New Brunswick Oilfields. It seems logical that a few contaminations might be attributable to natural sources, although this does not appear to be a large problem. No in-depth studies of the phenomenon have been conducted.

2.2 The Fundy Area

2.2.1 General Disscussion-Fundy Area

The Fundy Area is defined as that portion of drainage index subdivision 1BV which lies within Albert County. The Fundy Area comprises the south-southwest boundary portion of the Moncton Planning Region. The portion of this area within the region's boundary includes the Parishes of Alma, Harvey and Hopewell and minor portions of Elgin and Hillsborough Parishes. That portion of the drainage index subdivision 1BV not included within the Moncton Planning Region has been previously discussed (New Brunswick Department of the Environment, 1979). The Villages of Alma and Riverside-Albert are the only incorporated municipalities within the Fundy Area.

The boundaries of the Fundy area are described as follows: the northern boundary approximately parallels the northern parish boundaries of Alma, Harvey and Hopewell; the western boundary of that portion of the area within the Moncton Planning Region is the Albert County line; Chignecto Bay borders the southern boundary and the eastern boundary extends to include Demoiselle Creek. The fundy Area is shown in Figure (2.3).

The major rivers in this area are the Shepody River and the Upper Salmon River. The largest lakes in the area include Bennett Lake, McFadden Lake, Lockhart Lake and New Horton Lake. A complete listing of lakes within the area is included in Table (2.2).

There are two active hydrometric stations in the Fundy Area, which measure the natural flows of the Upper Salmon River near Alma and Point Wolfe River at Fundy National Park. The length of record at these stations is 11 and 16 years respectively

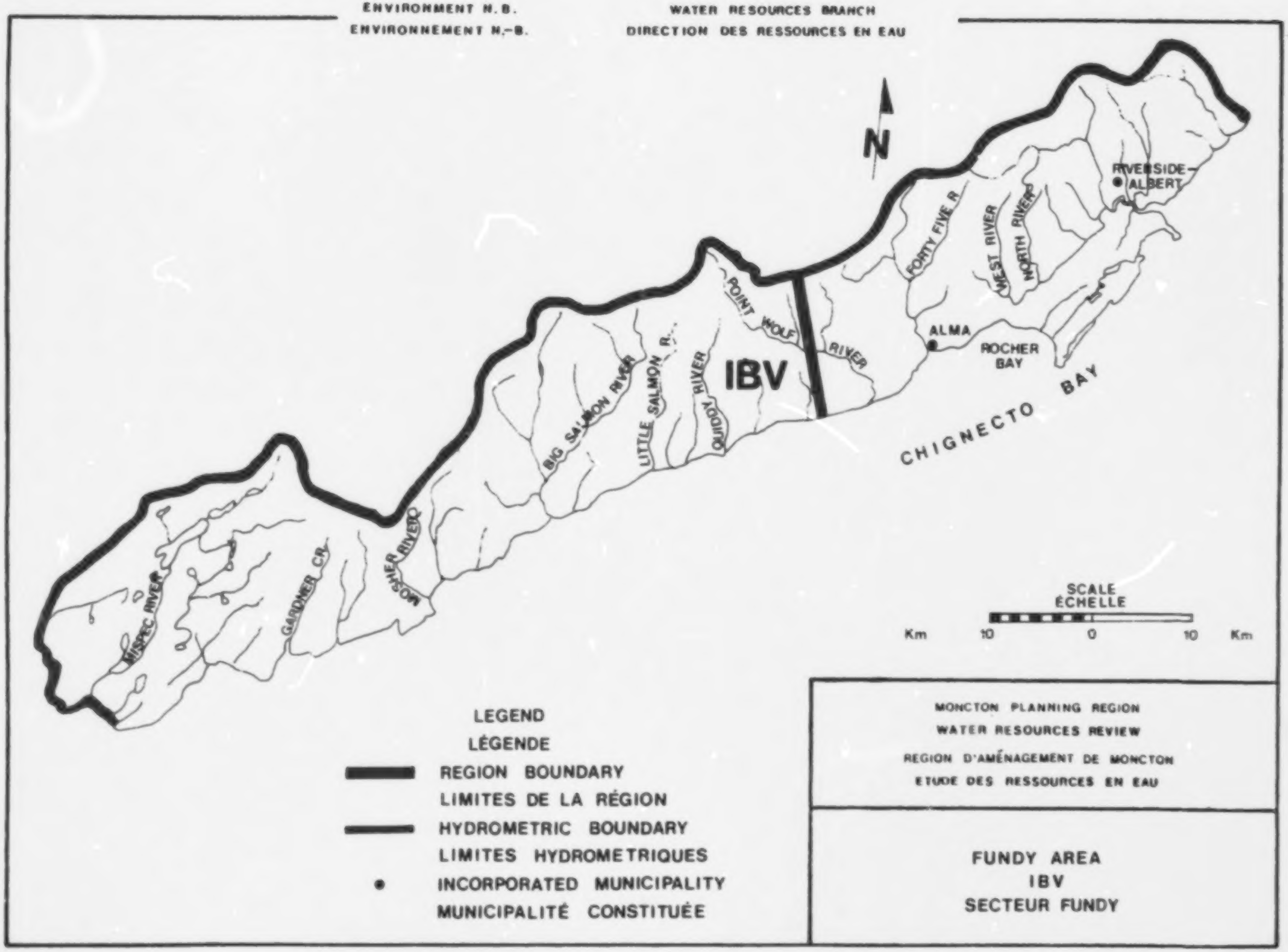

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.
WATER RESOURCES BRANCH
DIRECTION DES RESSOURCES EN EAU
N
RIVERSIDE-ALBERT
FORTY FIVE R.
WEST RIVER
NORTH RIVER
ALMA
ROCHER BAY
CHIGNECTO BAY
POINT WOLF RIVER
IBV
QUIDDY RIVER
LITTLE SALMON R.
BIG SALMON RIVER
MOSHER RIVER
GARDNER CR.
MISPEC RIVER
SCALE
ÉCHELLE
Km 10 0 10 Km
LEGEND
LÉGENDE
REGION BOUNDARY
LIMITES DE LA RÉGION
HYDROMETRIC BOUNDARY
LIMITES HYDROMETRIQUES
INCORPORATED MUNICIPALITY
MUNICIPALITÉ CONSTITUÉE
MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU
FUNDY AREA
IBV
SECTEUR FUNDY

FIG. 2.3

and the drainage areas are 181 and 130 sq. km. Flow duration curves for the hydrometric stations in the Moncton Region are presented in Appendix D. Low flow frequency analysis of these stations are presented in Appendix E.

2.2.2 Water Use-Fundy Area

There are two incorporated municipalities within the Fundy Area. These are the Villages of Alma and Riverside-Albert. Both of these communities are located on Route 114 which runs along the Fundy shoreline.

The residents of the Village of Alma secure water from private groundwater sources and well depths range from 11 m to 60 m. A spring fed cistern system is used communally by two to three dozen residences.

The Village of Riverside-Albert secures municipal water from a spring fed reservoir. There are thirty to forty residences within the municipality excluded from this municipal service. In these instances, water is secured from drilled wells, dug wells and spring fed sources. These residences will be included at a time when the present distribution system is expanded.

The private groundwater supplies for the Village of Alma are rated as generally good. Isolated occurrences of contaminated wells have been noted. The quality of Riverside-Albert's municipal water is good. Some private groundwater sources apparently experience problems relating to quality and quantity.

There are no major water users in either of these communities. There is no municipal waste water treatment facility in either Alma or Riverside-Albert. Both communities have experienced isolated problems of improperly treated sewage outletting into open ditch areas.

2.3 The Sackville-Shediac Area

2.3.1 General Discussion-Sackville-Shediac Area

The Sackville-Shediac area, defined as the drainage index subdivision 1BT, encompasses the southeast penninsula section of Westmorland County. The entire area lies within Westmorland County and includes the major portion of Shediac and Sackville Parishes and all of Botsford Parish. Four of the region's municipalities are located within this area. These include the Towns of Sackville and Shediac and the Villages of Port Elgin and Cap-Pele.

The Sackville-Shediac Area is defined on its northern boundary by Route 11; on the east by Northumberland Strait; on the South by Nova Scotia and Cumberland Basin and on the west by the Memramcook River drainage. The Sackville-Shediac Area is shown on Figure (2.4).

The area's major rivers are the Scoudouc River, the Gaspereau River and the Tantramar River. The four largest lakes within the Moncton Planning Region are located within the Sackville-Shediac area. These are Square Lake, Jolicure Lake, Big Jolicure Lake and Morice Lake. Other lakes are listed in Table (2.2).

There are no hydrometric stations located in the Sackville-Shediac area.

The chemical quality of groundwater in the area is within the guidelines for Canadian Drinking Water Standards, 1978.

2.3.2 Water Use-SAckville-Shediac Area

Four municipalities in the Moncton Planning Region are located within the Sackville-Shediac Area. They are the towns of Sackville and Shediac and the Villages of Cap-Pele and Port Elgin. With the exception of Sackville, each of these communities is situated on the east coast of Westmorland County.

Three of the area's incorporated municipalities have a public water supply. These municipalities rely on groundwater sources. The Village of Cap-Pele has no public water system and private wells have average depths of 7 to 30 metres.

Sewage treatment facilities are provided for all municipalities in the Sackville-Shediac Area.

The University of Mount Alison is the major user of municipal water in the Town of Sackville. This institution may use as many as 218 million litres of water a year. Enterprise Foundry Co. Ltd., a head and furnace manufacturer located in Sackville, used 59 million litres of water in 1981.

Fish processing and the operation of the Federal Fisheries Laboratory in Shediac account for most of the commercial water consumption in the Town of Shediac.

There is no major industrial or commercial water useage in the Villages of Port Elgin or Cap-Pele.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
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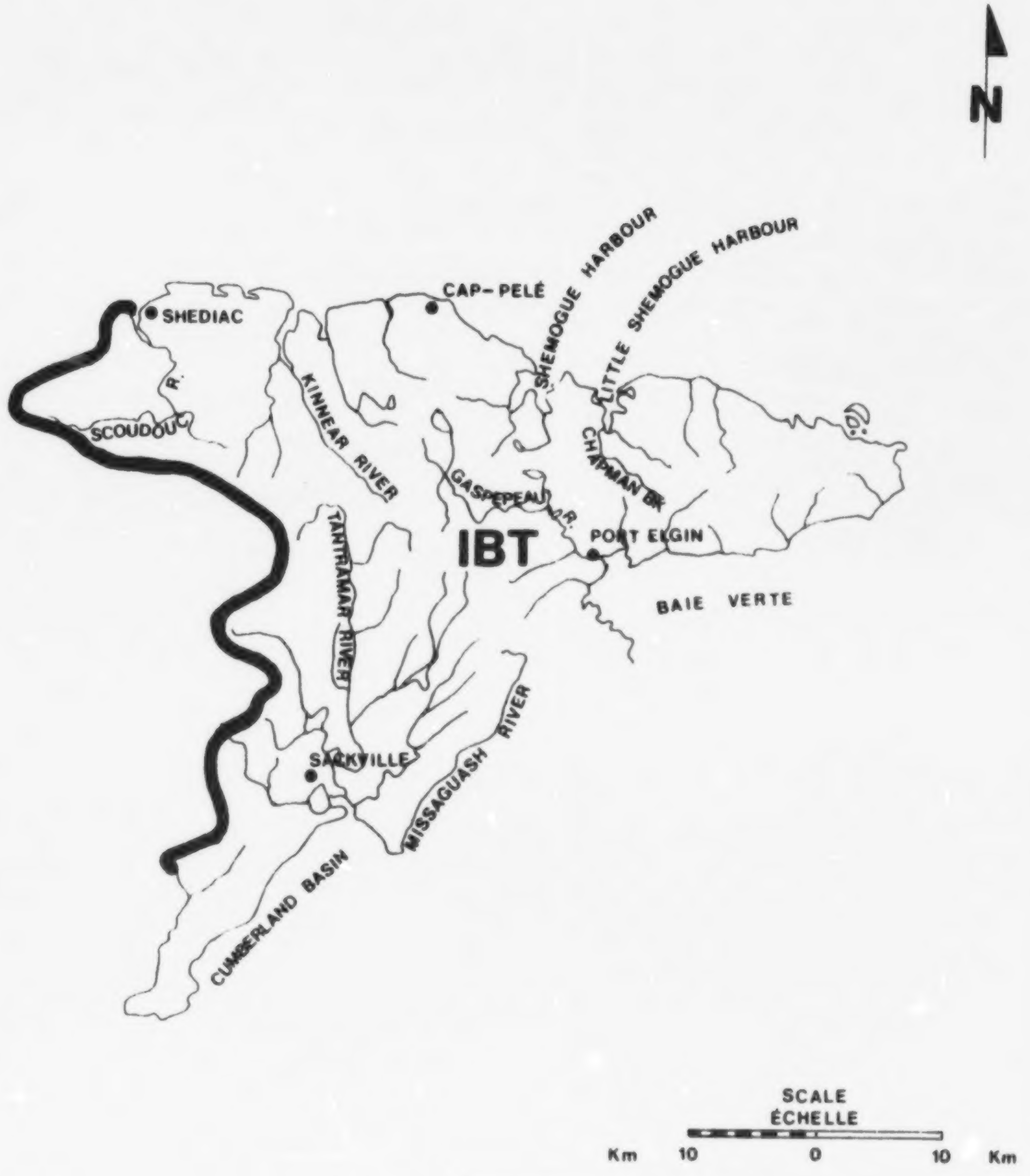
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SHEDIAC
CAP-PELÉ
SHEMOGUE HARBOUR
LITTLE SHEMOGUE HARBOUR
R.
SCOUDOUC
KINNEAR RIVER
GASPEREAU R.
CHAPMAN BR.
IBT
PORT ELGIN
BAIE VERTE
TANTRAMAR RIVER
SACKVILLE
MISSAGUASH RIVER
CUMBERLAND BASIN
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LEGEND
LÉGENDE

REGION BOUNDARY
LIMITES DE LA RÉGION
HYDROMETRIC BOUNDARY
LIMITES HYDROMETRIQUES
● INCORPORATED MUNICIPALITY
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ETUDE DES RESSOURCES EN EAU

SACKVILLE - SHEDIAC AREA
IBT
SECTEUR SACKVILLE - SHEDIAC

FIG. 2.4

2.4 The Petitcodiac Basin Area

2.4.1 General Discussion-Petitcodiac Basin ARea

The Petitcodiac Basin Area represents the drainage basin of the drainage index subdivision 1BU. The major portion of this area is contained within two counties, Albert County and Westmorland County. This area encompasses the Parishes of Elgin, Hillsborough and Coverdale in Albert County and portions of Salisbury and Moncton Parishes in Westmorland County. Portions of Havelock, Cardwell and Waterford Parishes in Kings County which lie outside of the region's boundary are also included.

The Petitcodiac Basin area encompasses the total drainage basin of the region's major river, the Petitcodiac River. The boundaries may be described as follows: south to parish boundaries of Alma, Harvey and Hopewell; west to the Albert County line and including headwater of Pollett River and Anagance River; north to include drainage of North River and east to include drainage of Memramcook River system.

Seven of the regions incorporated municipalities are located within this area. These include the City of Moncton, the Towns of Riverview and Dieppe and the Villages of Petitcodiac, Salisbury, St. Joseph, Dorchester and Hillsborough. A map of the Petitcodiac Basin Area is presented in Figure (2.5).

There are three active hydrometric stations in the Petitcodiac Basin Area. All of these stations are regulating natural flows: Petitcodiac River near Petitcodiac, Turtle Creek at Turtle Creek and Palmers Creek near Dorchester measures over a drainage area of 391 sq. km, 129 sq. km and 34.2 sq. km respectively. The extreme maximum and minimum daily flows at these stations are presented in Appendix C. The hydrometric network is further discussed in Section (4.6).

The water quality is generally good except for isolated occurrences of excessive iron and manganese concentrations (i.e. Dorchester, Saint Joseph, Petitcodiac). Some community spokesman in the Villages of Hillsborough and Dieppe, express dissatisfaction of the aesthetic qualities of their present supplies. The communities of Petitcodiac, Salisbury and Dorchester believe their water to be excessively "hard". It is noted that these are aesthetic considerations which do not render water unsafe for drinking.

Water secured from the municipal wells in the Village of Port Elgin is alkaline and exceeds the guidelines for Canadian Drinking Water Quality, 1978 (i.e. greater than 8.5 pH units). The Town of Shediac's water supply is also relatively alkaline (pH 8.7).

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
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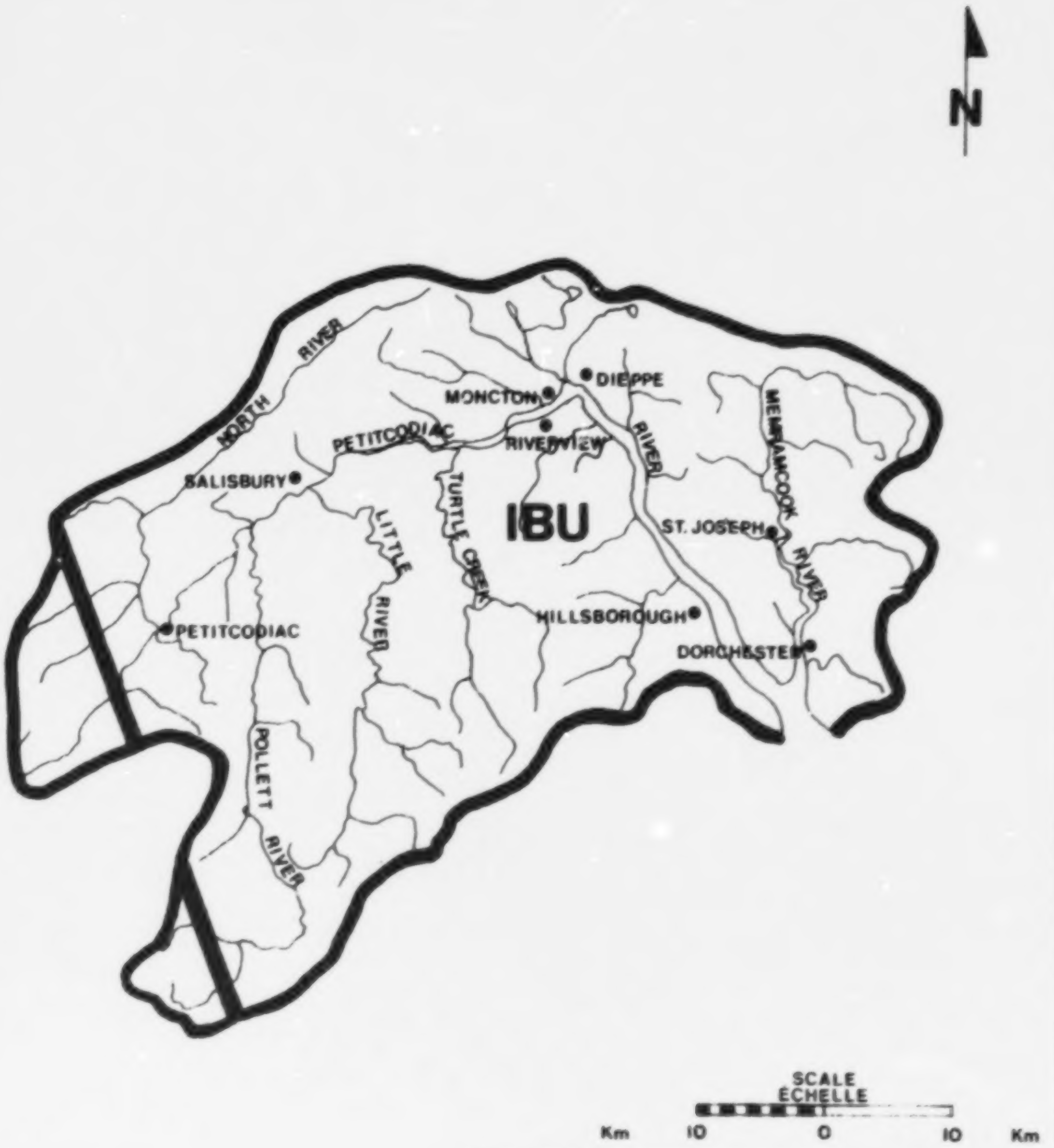
N
NORTH RIVER
DIEPPE
MONCTON
PETITCODIAC
RIVERVIEW
RIVER
MEMRAMCOOK RIVER
SALISBURY
IBU
LITTLE RIVER
TURTLE CREEK
ST. JOSEPH
HILLSBOROUGH
PETITCODIAC
DORCHESTER
POLLETT RIVER
SCALE
ÉCHELLE
Km 10 0 10 Km

LEGEND
LÉGENDE

- ▬ REGION BOUNDARY / LIMITES DE LA RÉGION
- ▬ HYDROMETRIC BOUNDARY / LIMITES HYDROMETRIQUES
- ● INCORPORATED MUNICIPALITY / MUNICIPALITÉ CONSTITUÉE

MONCTON PLANNING REGION
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ETUDE DES RESSOURCES EN EAU

PETITCODIAC BASIN AREA
IBU
SECTEUR BASSIN PETITCODIAC

FIG. 2.5

Manganese in concentrations above those recommended for Canadian Drinking Water Quality, 1978 is found in a well supply in Shediac and in all of Sackville's water supply sources. Excessive iron & manganese concentrations is a problem for Sackville's water users.

2.4.2 Water Use-Petitcodiac Basin Area

Eight of the incorporated municipalities in the Moncton Planning Region are located within the Petitcodiac Basin Area. These municipalities include the City of Moncton, the Towns of Dieppe and Riverview and the Villages of Saint Joseph, Dorchester, Hillsborough, Salisbury and Petitcodiac. All of these communities with the exception of Salisbury, are located in close proximity to major rivers in the area.

Three of the eight communities rely on private ground water sources for their water supply. Three of the remaining communities share a surface water supply (Turtle Creek in Moncton). The Village of Saint Joseph has both ground and spring water sources.

All municipalities with the exception of Moncton, Dieppe and Riverview have sewage treatment facilities. The lack of sewage treatment facilities for three of the areas largest municipalities results in untreated sewage being discharged into the estuary. Intrusion through the control gates at the causeway probably further contributes to the decline in water quality in the lower end of the Petitcodiac watershed.

The major industrial establishments in the Petitcodiac Basin Area, are located within and in the vicinity of the City of Moncton. Among the approximately ten dozen major users in 1981 are: Brunswick Bottling (232 million litres), C.N. R. (364 million litres). Fiberglass Canada (106 million litres), Hub Meat Packers (127 million litres), Combustion Engineering (114 million litres), University of Moncton (141 million litres). All of these users secure their water needs from the City of Moncton water supply.

Headwater streams within the area provide good quality water and suitable grounds for sport fishing, hydro-generating facilities, agricultural land use and fisheries programs.

The major rivers draining the Petitcodiac Basin Area are the North River, the Anagance River, the Pollett River, the Little River, the Petitcodiac River and the Memramcook River. The Petitcodiac River has a drainage area of 2,071 sq. km. Memramcook Lake is the area's largest lake with an area of 0.30 sq. km. A list of the area's lakes is presented in Table (2.2).

2.5 Eastern Shore Area

2.5.1 General Discussion-Eastern Shore Area

The Eastern Shore Area is defined as the drainage index subdivision 1BS. The area is contained with portions of two counties, Kent County and Westmorland County. It includes the following Parishes in Kent County: Richibucto, Weldford, St. Paul, St. Mary, Wellington, Dundas and portions of Hushisson and Harcourt Parishes. It also includes portions of Shediac and Moncton Parishes in Westmorland County. Generally, it represents the drainage of the estuarine rivers, Richibucto River, Buctouche River, Cocagne River and Shediac River.

The area is bordered on the east by the Northumberland Strait. The west boundary extends to include Route 126 and those portions beyond Route 126 necessary to encompass the headwater drainage of the Richibucto River, Coal Branch River and Cocagne River. The southern boundary extends to Route 11 and the northern boundary extends to include the drainage of the Richibucto River Basin.

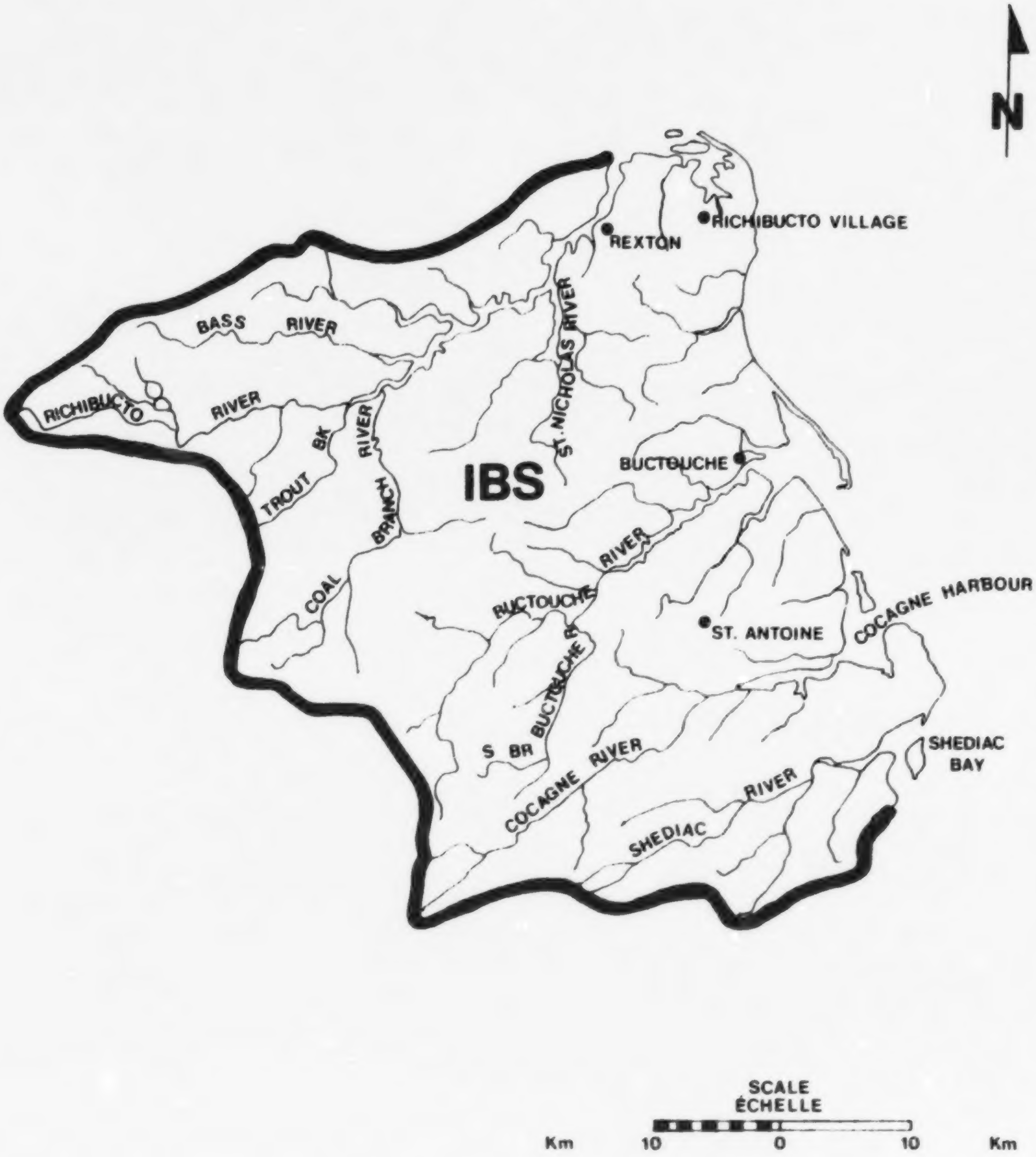
The Eastern Shore area has four incorporated municipalities, the Villages of Richibucto, Rexton, Buctouche, and St. Antoine. The Eastern Shore area is shown on Figure (2.6).

The area's major rivers are estuarine and include the Richibucto River, the Buctouche River, the Cocagne River and the Shediac River. The Coal Branch, the St. Nicholas River and the Bass River are tributaries to the area's largest river; the Richibucto River (1,077 sq. km) Coal Branch Lake is the area's largest lake (0.44 sq. km). Table (2.2) presents a complete listing of the area's lakes.

The water quality in the Eastern Shore Area ranges from good to poor. Groundwater from wells in communities in the south of Kent County (e.g. Buctouche, St. Antoine) have a high concentration of manganese and iron. Some wells tested in Buctouche also showed groundwater was slightly alkaline (exceeding the Canadian Drinking Water Standards, 8.3 pH) and slightly corrosive. Spokesmen for the Village described the water quality as "poor". The Village of Rexton has hard but acceptable drinking water.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


N
RICHIBUCTO VILLAGE
REXTON
BASS RIVER
RICHIBUCTO RIVER
ST. NICHOLAS RIVER
TROUT BK
RIVER
COAL BRANCH
IBS
BUCTOUCHE
BUCTOUCHE RIVER
BUCTOUCHE R
S BR
ST. ANTOINE
COCAGNE HARBOUR
COCAGNE RIVER
SHEDIAC RIVER
SHEDIAC BAY
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LEGEND
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▬ REGION BOUNDARY
LIMITES DE LA RÉGION
— HYDROMETRIC BOUNDARY
LIMITES HYDROMETRIQUES
● INCORPORATED MUNICIPALITY
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REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

EASTERN SHORE AREA
IBS
SECTEUR RIVAGE D'EST

FIG. 2.6

2.5.2 Water Use-Eastern Shore Area

Four of the region's Villages are situated within the Eastern Shore Area. Three of these, Richibucto, Rexton, and Buctouche are located near the mouth of estuarine rivers. The Village of St. Antoine is the exception. All of the municipalities in the Eastern Shore Area use private wells to secure their water supplies.

All four Villages have a municipal waste treatment facility. The major industrial enterprise within this area is the newly constructed electronics plant in the Village of Buctouche. When this industry is in operation, it is expected to have a water demand estimated as 30.3 l/s, as well as an additional possible future demand of 15 l/s. A food processing enterprise, a distillery and fish processing plants are the area's other major industrial establishments.

2.6 Kouchibouguac Area

2.6.1 General Discussion-Kouchibouguac Area

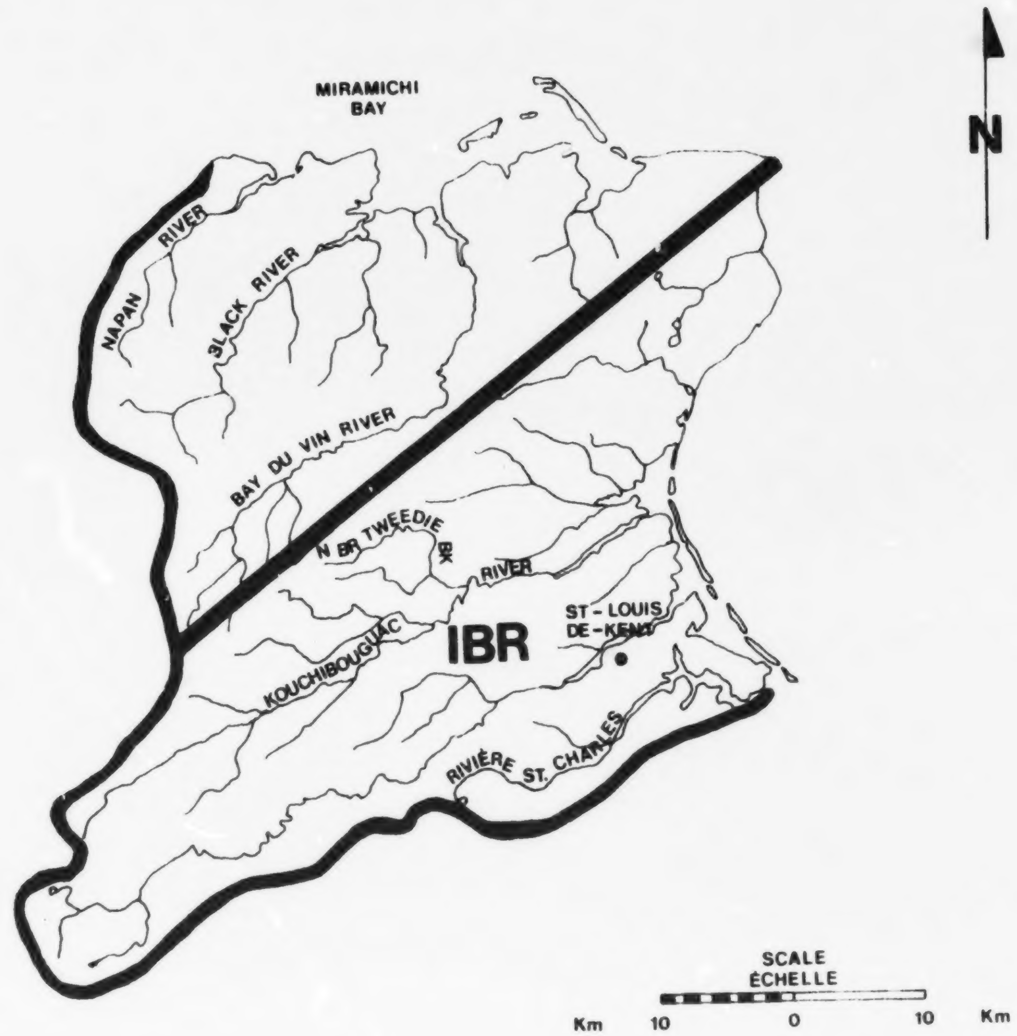
The Kouchibouguac Area comprises the northern end of the Moncton Planning Region. The area does not lie entirely within the Moncton Planning Region. The Kouchibouguac Area is defined as that portion of drainage index subdivision 1BR which is located within Kent County. The remaining portion of the area has been discussed in the Newcastle-Chatham Water Resources Review Report.

The northern boundary of that portion of the Kouchibouguac Area which is located within the Moncton Planning Region is the Kent County line; Northumberland Strait borders the eastern limits; the south boundary is defined by the southern limits of St. Charles Parish. The west boundary extends to include the headwater of Kouchibouquasis River.

Acadieville, Carleton, St. Louie and St. Charles are the four Parishes which comprise this portion of the drainage index subdivision 1BR (Kouchibouguac Area). There is one incorporated municipality within this area, St. Louis de Kent. The Kouchibouguac Area is shown in Figure (2.7).

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


MIRAMICHI BAY
NAPAN RIVER
BLACK RIVER
BAY DU VIN RIVER
N BR TWEEDIE BK
RIVER
KOUCHIBOUGUAC
IBR
ST-LOUIS DE-KENT
RIVIÈRE ST. CHARLES
N
SCALE
ÉCHELLE
Km 10 0 10 Km

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▬ REGION BOUNDARY
LIMITES DE LA RÉGION
▬ HYDROMETRIC BOUNDARY
LIMITES HYDROMETRIQUES
● INCORPORATED MUNICIPALITY
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MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

KOUCHIBOUGUAC AREA
IBR
SECTEUR KOUCHIBOUGUAC

FIG. 2.7

The major rivers in the area are the Kouchibouguac River, the Black River, the Kouchibouquasis River and the Riviere St. Charles. The area has several small lakes, the largest of which are Lac a Livain (.41 sq. km) and McLain Lake (.33 sq. km). See Table (2.2) for a listing of the lakes in this area.

Groundwater quality of water tested in St. Louis de Kent indicates that water in the area is expected to be good.

2.6.2 Water Use-Kouchibouguac Area

There are no major industrial or commercial users of water in this area. Kouchibouguac National Park is located within this area and tourism represents the major activity of this largely unpopulated area.

2.7 Upper Salmon Area

2.7.1 General Discussion-Upper Salmon Area

The Upper Salmon Area is located in the northwest and central-west portions of the Moncton Planning Region. It is defined as the combined area of that portion of drainage index subdivision 1AN and that portion of drainage index subdivision 1AP which lie within the Planning Region. This total area encompasses the headwater of the Salmon River and the Canaan River.

The major part of this area (1AN) is included in the Parish of Harcourt in Kent County. The portion of 1AP which lies in the Moncton region is mainly located in the Parish of Salisbury.

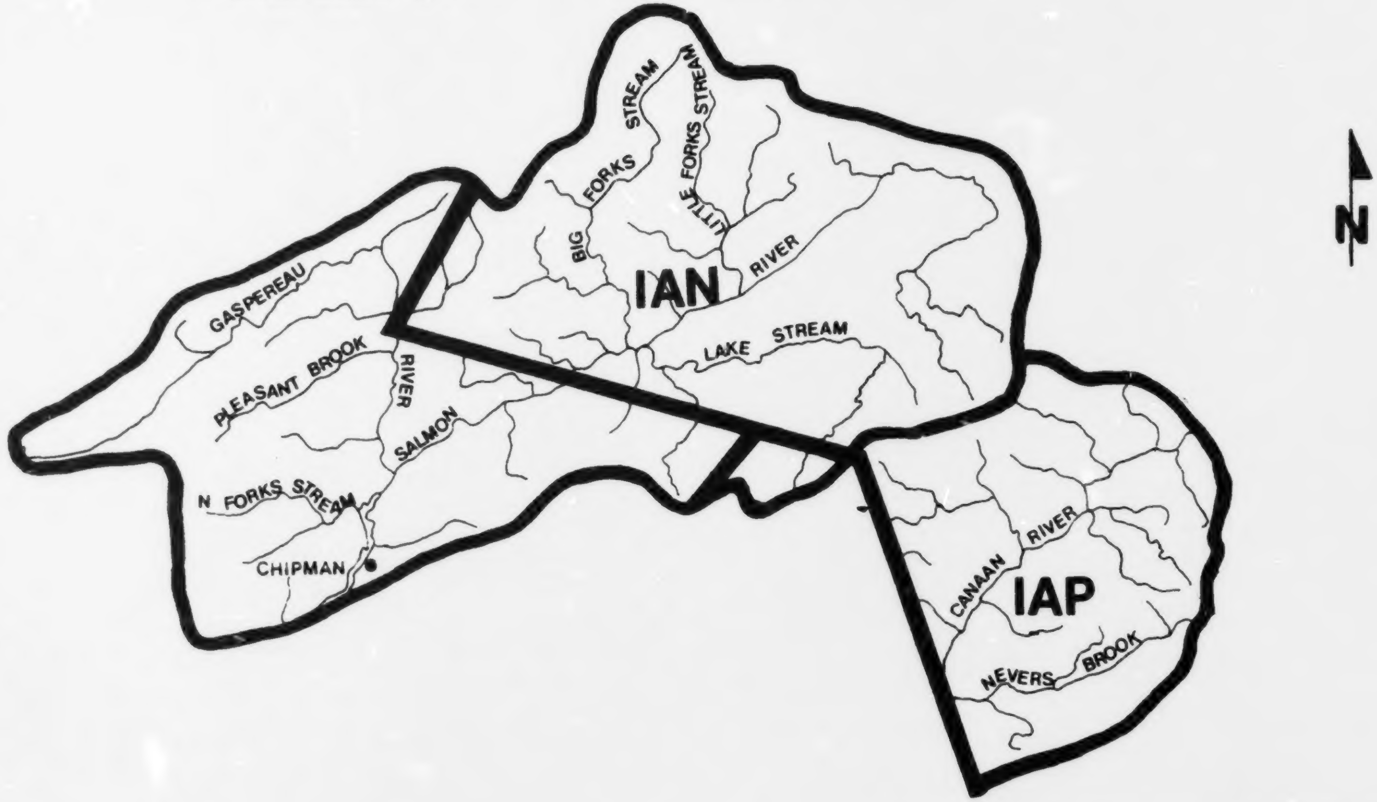
The boundaries of the Upper Salmon Area may be defined as follows: southwest to Kent county line; northwest to the drainage of Sabbies River; north to Huskisson Parish line and including drainage of Big Focks Stream; east to Route 126 but excluding drainage of Richibucto River system. The Upper Salmon Area is shown in Figure (2.8).

The major rivers in this area include Salmon River with a drainage area of 1,863 sq. km. and Canaan River with a drainage area of 1,558 sq. km. There are no lakes of any significant size in this area. The largest lake is located in the drainage subdivision 1AN, Trout Brook Lake (.17 sq. km).

There are three active hydrometric stations in the Upper Salmon River area. All three measure natural flow regimes: Salmon River at Castaway, Castaway Brook near Castaway and Canaan River at East Canaan. The length of record at these stations varies from 6 to 34 years and the drainage areas range from 1050 to 34.4 sq. km. Flow duration curves for the hydrometric stations in the area are presented in Appendix D. Low flow frequency analysis of these stations are presented in Appendix E.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSOURCES EN EAU


N
IAN
IAP
BIG FORKS STREAM
LITTLE FORKS STREAM
RIVER
LAKE STREAM
GASPEREAU
PLEASANT BROOK
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MONCTON PLANNING REGION
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ETUDE DES RESSOURCES EN EAU

UPPER SALMON AREA
IAN, IAP
SECTEUR SALMON SUPÉRIEUR

FIG. 2.8

2.7.2 Water Use-Upper Salmon Area

There are no incorporated municipalities within this area. The area encompasses the headwater drainage area of two southeasterly flowing rivers, the Salmon River and the Canaan River. This area is mainly forested wilderness. The Canaan Game Management Area Reserve is located here as well.

There are no lakes of any significant size located within this area.

CHAPTER THREE

THE COMMUNITY WATER SUPPLIES

3.1 Introduction

There are nineteen municipalities within the Moncton Planning Region. Ten municipalities are located within one area, the Petitcodiac Basin Area. With one exception, the remaining nine municipalities are scattered along the eastern and southern shore line of the region with the main concentration of settlements near fishing harbours.

Eleven municipalities in the Moncton Planning Region have public water supply systems as shown in Table (3.1). Seven of these municipalities rely on ground water sources for their public supply. One community have a ground/surface supply, and three share a common surface supply. Private wells are used in all municipalities which do not have a municipal supply.

Thirteen of the region's 19 municipalities have public wastewater treatment systems. Three municipalities, which comprise part of the Greater Moncton Metropolitan area, are among those which do not. The major portion of wastewater generated within this area discharges untreated water into the Petitcodiac River. Waste treatment, in this instance, is a requirement to meet provincial regulations. At the time of writing, the City of Moncton, the Town of Riverview and the Town of Dieppe have formed the Greater Moncton Sewage Commission and are jointly giving consideration to a consultant's report on a sanitary sewage collection and treatment system for the greater Moncton area. (Boyd A. Touchie Engineering Ltd., 1983).

The three other communities in the region which do not have municipal waste treatment, rely on private septic tanks for waste disposal.

There are many advantages for having public water supply and disposal systems in an urban community. The major advantage is that the water supply is drawn from a single source which can be under continuous control with regard to the quantity and quality of water. Such control may include: source protection, ownership, monitoring of quality and consumption, evaluation of source capacity, and "real" management. A public disposal system also eliminates private well contamination, a problem that is always associated with sewage handling (mostly septic tanks). Proper fire protection can be provided under a water supply system. This in turn can reduce fire insurance premiums and encourages business and industrial development which enhance the economy of the community.

The following sections outline the present and projected features of the various incorporated communities in the Moncton Planning Region and the associated water supply considerations.

TABLE (3.1) GENERAL INFORMATION ON WATER SUPPLIES AND WASTE TREATMENT SYSTEMS

MUNICIPALITY	STATUS	WATER SUPPLY				WASTEWATER SYSTEMS		
		SYSTEM	SOURCE	AVE. FLOW MILLION LITRES per day	TREATMENT PLANTS	AVAIL-ABILITY	AVE. FLOW kg/ha/day	TREATMENT PLANTS
1. Alma	Village	No	Ground	-	-	No	-	-
2. Buctouche	Village	No	Ground	-	-	Yes	1.6	2 cell
3. Cap-Pélé	Village	No	Ground	-	-	Yes	3.2	1
4. Dieppe	Town	Yes	Surface	4.1	Yes	No	-	-
5. Dorchester	Village	Yes	Ground	-	No	Yes	3.24	1
6. Hillsborough	Village	No	Ground	-	-	Yes	3.2	1
7. Moncton	City	Yes	Surface	46.0	Yes	No	-	-
8. Petitcodiac	Village	No	Ground	-	-	Yes	2.0	1
9. Port Elgin	Village	Yes	Ground	0.046	No	Yes	2.8	1
10. Rexton	Village	No	Ground	-	-	Yes	4.0	1
11. Richibucto	Village	Yes	Ground	-	No	Yes	5.3	2
12. Riverside-Albert	Village	Yes	Ground	-	No	No	-	-
13. Riverview	Town	Yes	Surface	3.41	Yes	No	-	-
14. Sackville	Town	Yes	Ground/ Surface	4.5-7.3	Yes	Yes	11.6	2 cell
15. Saint Antoine	Village	No	Ground	-	-	Yes	4.7	3
16. Saint Joseph	Village	Yes	Ground	0.27-0.36	Yes	Yes	3.0	1
17. St.-Louis-De-Kent	Village	Yes	Ground	-	No	Yes	1.3	2
18. Salisbury	Village	No	Ground	-	-	Yes	8.1	3
19. Shediac	Town	Yes	Ground	1.78-2.73	Yes	No	-	2 cell

3.2 The Village of Alma

The Village of Alma is located in the Parish of Alma in Albert County. Situated on the shore of Cumberland Bay, the village centre lies between the lower reaches of the Upper Salmon River and Cleveland Brook. Fundy National Park is located to the immediate west of the village. Alma is approximately 80 km southwest of Sussex via Highway 114.

The Village of Alma serves as a seasonal service centre for the Fundy National Park tourist trade. The present economy of the village is based entirely on the National Park.

Alma, as it stands today, is a town almost wholly constructed since fire destroyed the village in 1926. The village was incorporated in 1966.

POPULATION: In the early 1800's the economy of Alma Parish was based securely on the profitable fishing and lumbering trade. In the latter part of the 19th century and until the 1930's Alma also supported a large shipbuilding industry. As natural resources in Alma Parish began to decline, so did the population of the village. This trend was noticed as early as 1881. The number of residences at that time numbered 1,263. Although population projections predicted a stalilization because of the Fundy Park employment base, this has not been realized.

In 1981, the census population in the Village of Alma was 329 people in a total of 130 occuppied dwellings.

YEAR	CENSUS POPULATION
1971	425
1976	334
1981	329

TOPOGRAPHY: The general topography of the Alma Area is characterized by high hills sloping steeply (20%) or more) towards the Upper Salmon River and the Bay of Fundy.

Alma lies within a narrow band of carboniferous rocks which run parallel to Chignecto Bay. This series of rocks is separated from similar formations in the remaining portion of the province by a massive band of an extremely old Precambrian series. The carboniferous rocks in the area are separated into the Pennsylvanian series (red to grey sandstone, conglomerate and siltstone). The unconsolidated recent deposits are mainly glacial sandy-gravelly tills of varying thickness with some shallow outwash sands and gravels along the Alma River. (Can-Plan Consultants Ltd., 1974).

WATER SUPPLY: Alma residents secure their water mainly from private wells which vary in depth from 11 m to over 60 m. Three private water lines from a cistern system north of Highway 114 in the village centre service two or three dozen homes located on both sides of the highway. Ninety-nine year leases secure the distribution right of way over private land. The freezing of these distribution lines in winter is sometimes a problem. Refer to Figure 3.1 for sketch of the village.

WATER QUALITY: The village major describes the quality of groundwater in the Village of Alma as "good". Two private wells located on Fundy View Street near the Orange Hall have been contaminated. One well, hand dug, developed a "bad smell" in 1980 and the other was apparently contaiminated by petroleum. Water from the post office well has a red colour and has a high iron content. There are several old petroleum storage tanks buried near the post office location. Water at a local service station is not used for drinking because of its salty taste. No well histories are available. Several wells on Ocean Drive had to be re-drilled before good quality water could be secured at this location of the village.

WASTEWATER TREATMENT: Sewage treatment in the Village of Alma is by individual septic tanks and drainage fields. There apparently are some isolated problems with improperly treated domestic waste water outletting into open ditches. The population density in the Village of Alma during tourist season presents a problem of over-worked septic systems and the possible danger of groundwater pollution.

FIRE PROTECTION: Cleveland Brook is used to supply the village's three pumpertruck for fire fighting. This source is seen as being adequate for that purpose.

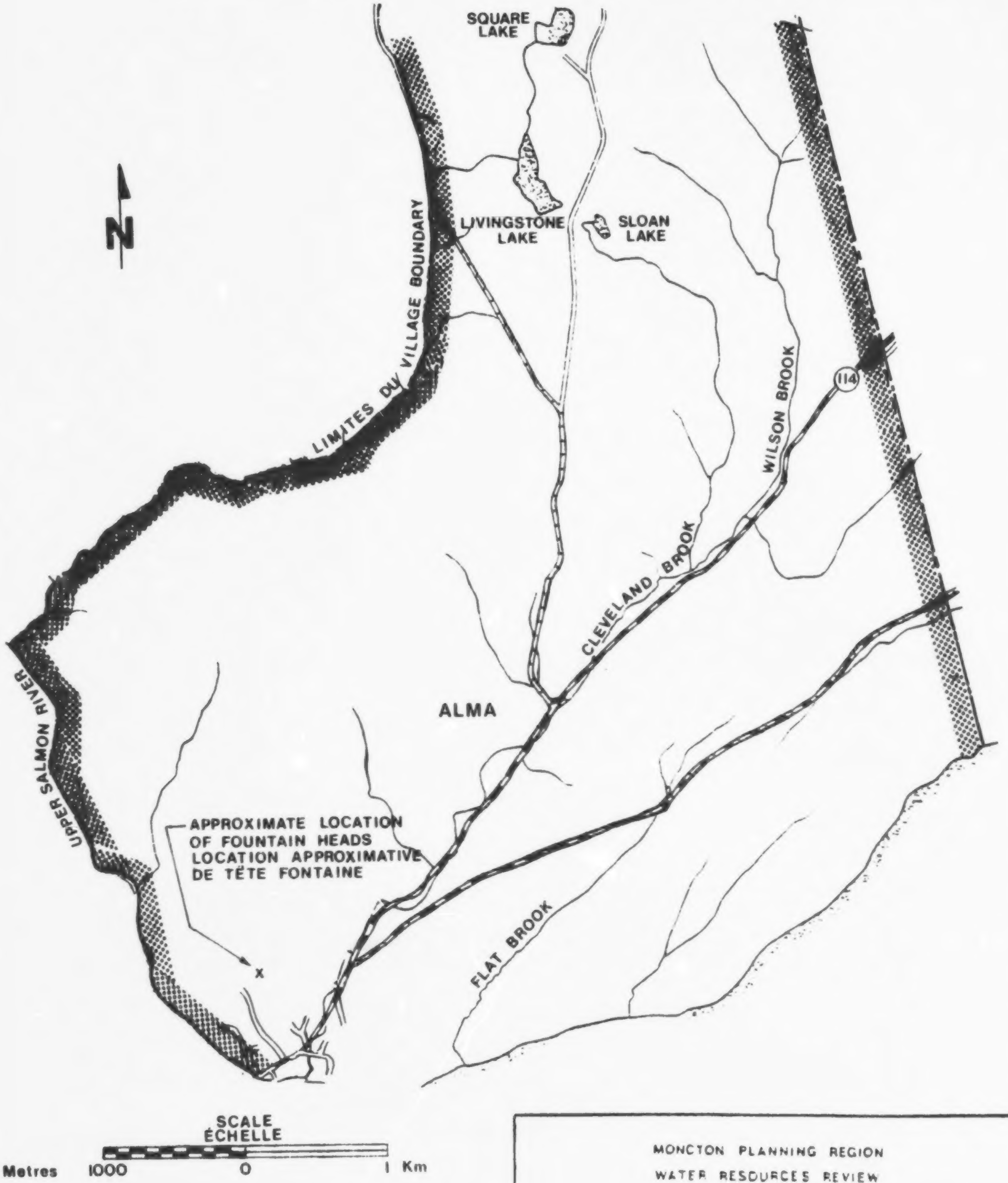
3.3 The Village of Buctouche

The Village of Buctouche is situated on the shores of the Buctouche River at the mouth of Buctouche Harbour. The village is located in the Parish of Wellington in Kent County and is one of several coastal villages in Kent County located at the crossroads of an estuarine river and the coastal highway. The main highway access to the village is Route 11. Moncton is approximately 70 km to the southwest and Chatham is about 90 km to the northwest. The Village of Buctouche was incorporated in 1966.

The village's area is approximately 18,600 ha. and the general topography is flat with moderate sloping towards the river.

ENVIRONMENT N.B.
ENVIRONNEMENT N-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSORCES EN EAU


SQUARE LAKE
LIVINGSTONE LAKE
SLOAN LAKE
N
LIMITES DU VILLAGE BOUNDARY
WILSON BROOK
114
CLEVELAND BROOK
UPPER SALMON RIVER
ALMA
APPROXIMATE LOCATION OF FOUNTAIN HEADS
LOCATION APPROXIMATIVE DE TÊTE FONTAINE
x
FLAT BROOK
SCALE
ÉCHELLE
Metres
1000
0
1 Km

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

WATER SOURCES
ALMA
SOURCES D'EAU

FIG. 3.1

POPULATION: The 1981 census population for the Village of Buctouche was 2,476. This is a 3% decrease over the 1976 census population of 2,566 (1976 was a year of boundary change for comparison purposes, adjusting the 1971 census to 1976 boundaries suggests a population of 2,214). The number of occupied dwellings in 1981 was 675.

YEAR	POPULATION	%CHANGE
1971	1,964	
1971	2,214[1]	
1976	2,566	15% increase from 1971 to 1976
1981	2,476	3% decrease from 1976 to 1981

[1] Population based on 1976 boundaries

WATER SUPPLY: The residents of the Village of Buctouche secure water from private wells. The recently constructed Mitel electronics plant located on the north bank at the southern boundary of the Village of Buctouche will be the village's major water user. The location of its water supply was chosen to serve the future water needs of the Village of Buctouche as well. It is estimated that the Mitel plant operation will use 30.3 l/s of water when it begins operation (date unknown). Projections of the future water demands for this industry have been estimated at an additional 15 l/s (Water Management Services, 1982). (As of December, 1984, the Mitel Plant is still not operating and the Village has taken over the water system.) A 6.75 million litre reservoir is located in the north of the village in the vicinity of McLaughlin Avenue, Figure (3.2). The distribution line runs south by way of Rue De L`Eglise to Route 134. There are 30 to 35 private homes now connected to this water supply. Municipal officials expect more homes will take advantage of the municipal supply, either as a back-up supply or as an alternative to replacing old private pumping systems. The village's two schools, the church and the arena, use this municipal supply.

WATER QUALITY: In 1982, a study of the availability of a water supply for the Mitel electronics plant at Buctouche was done. At this time, a water quality analysis on samples from test wells and observation wells showed all waters tested to be slightly alkaline with pH values ranging from 8.2 to 9.1. Canadian Drinking water standards give a pH range of 6.5 to 8.5 as acceptable. This high pH reduces the solubility of iron and

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WATER RESOURCES BRANCH
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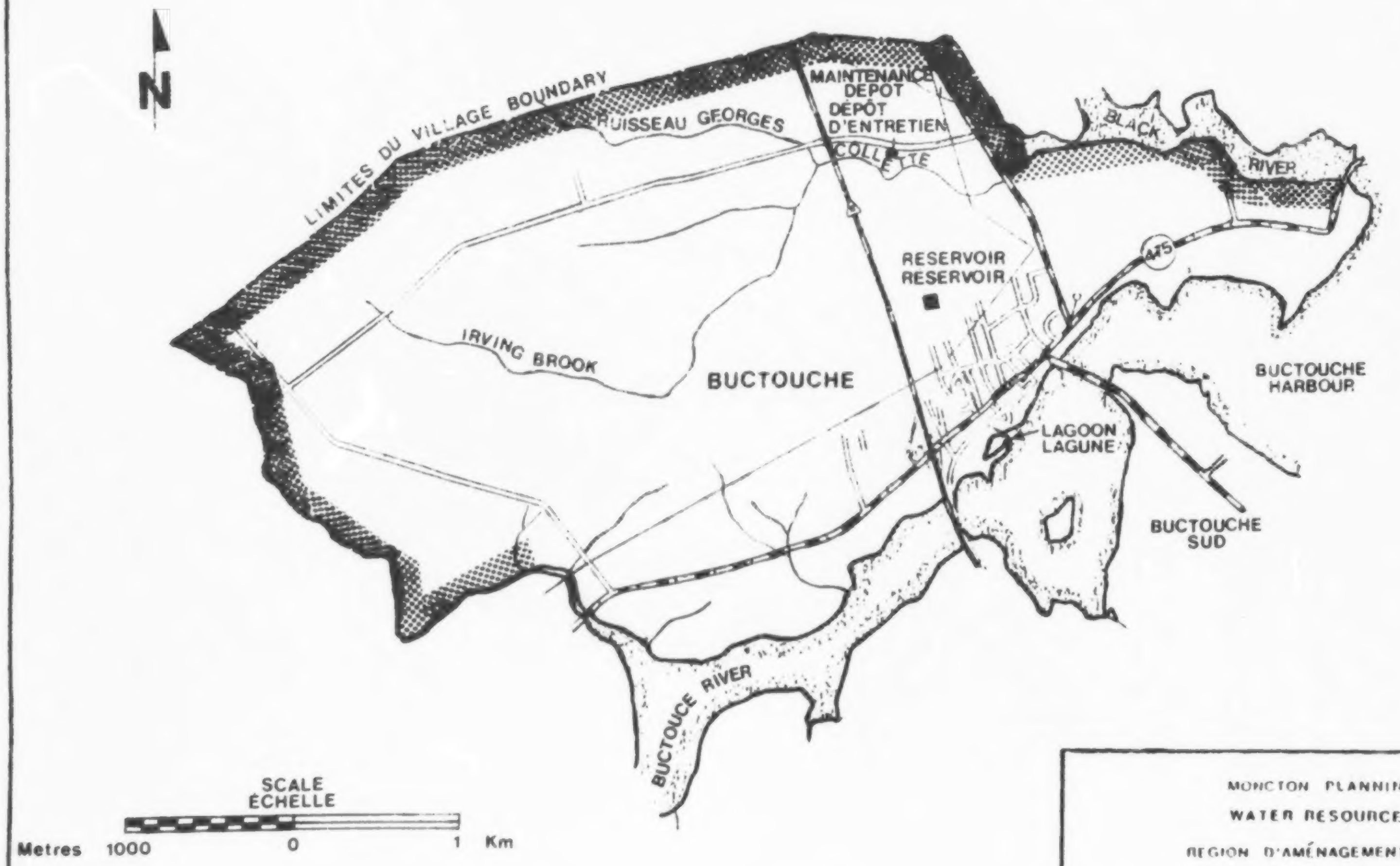

N
LIMITES DU VILLAGE BOUNDARY
RUISSEAU GEORGES
MAINTENANCE DEPOT
DÉPÔT D'ENTRETIEN
COLLETTE
BLACK RIVER
475
RESERVOIR
RESERVOIR
IRVING BROOK
BUCTOUCHE
BUCTOUCHE HARBOUR
LAGOON
LAGUNE
BUCTOUCHE SUD
BUCTOUCE RIVER
SCALE
ÉCHELLE
Metres 1000
0
1 Km

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

WATER SOURCES
BUCTOUCHE
SOURCES D'EAU

FIG. 3.2

manganese and consequently these metals were found to be present in small amounts only. The waters may be classified as slightly corrosive. See Table (3.2) for the results of water quality analysis done on test wells #8, #5 & #1.

WASTEWATER TREATMENT: The Village of Buctouche has a municipal sewage collection and treatment plant. A 1.6 hectare aerated waste stabilization pond (2 cell) is located on the north bank of the Buctouche River. The discharge is into the Buctouche River. Operating conditions at the plant are detailed in Table (3.3). In 1983, an expansion to a lift station was completed. Also, water and sewer services were installed on Richard Ave, Park Ave., and in the Bicentennial Trailer Park.

FIRE FIGHTING: The village secures its water for fire protection from a pond (unnamed) off Irving Blvd. A backup well with an approximate depth of 90 m is used during the winter season. (Pumping capacity is unknown). The village has 12 hydrants.

FLOODING: There are no dwellings on the flood plain within the municipal boundaries. There has been no flood damage in the Village of Buctouche in the past 20 years.

3.4 The Village of Cap Pélé

The Village of Cap Pélé is situated in the south-east cape area of Westmorland County. Located on the Northumberland Strait coast in Botsford Parish, the village is 45 km from Moncton and 19 km from the Village of Shediac by way of Route 15.

The municipality of Cap Pélé encompasses 2,330 ha. of land and is comprised of three distinct sections: (1) Centreville, a residential, commercial and institutional sector; (2) Dupuis Corner, a commercial and residential section and (3) Bas Cap Pele, a residential and industrial area. The village was incorporated in 1969. The principle economic activity centers around several fish processing operations.

POPULATION: The 1981 census population of Cap Pele is 2,199. This figure indicates a slight decline in total population of approximately 100 over the 1976 census count of 2,287. The total number of occupied dwellings in 1981 was 598. On the basis of the 1981 population this represents an average of 3.77 people per household.

YEAR	CENSUS POPULATION
1971	2,080
1976	2,287
1981	2,199

TABLE 3.2 WATER ANALYSIS BUCTOUCHE WATER SUPPLY

	TEST WELL #8 72 hr	TEST WELL #5 72 hr	TEST WELL #1 24 hr
CONDUCTIVITY	250.00	260.00	230.00
pH	8.30	8.70 *	9.10 *
Turbidity	0.47	0.28	2.80
Alkalinity (P)	120.00	6.80	9.60
Alkalinity (T)	7.20	130.00	100.00
Chloride	0.18	7.40	7.00
Floride	55.00	L0.10	L0.10
Sodium	21.00	57.00	43.00
Hardness	0.95	29.00	30.00
Magnesium	6.90	1.00	1.40
Calcium	6.20	10.00	9.50
Sulfate	0.68	7.90	8.10
Potasium	0.05	0.82	0.73
Nitrate/Nitrite	L0.01	0.02	L0.01
Nitrite	L0.01	L0.01	0.09
Zinc	0.01	L0.01	L0.01
Manganese	0.05	0.05	0.05
Iron	L0.05	L0.05	L0.05
Lead	0.04	L0.05	L0.05
Copper		0.02	L0.01

Source: Water Management Services,"Location and Testing of a Water Supply for the Mitel Plant," Buctouche New Brunswick, 1982.

*Exceeds maximum acceptable limits (pH 6.5-8.5) for Canadian Drinking Water Quality, 1978.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Buctouche

TABLE (3.3)

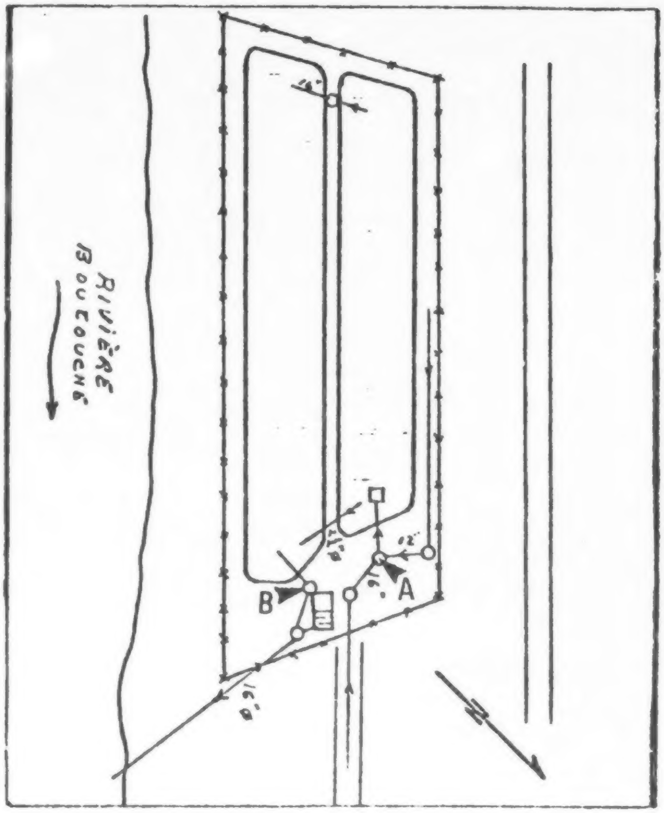
POPULATION 2,556

SURFACE DU BASSIN
POND AREA 1.6 aéré/aerated

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY

MISE EN OPERATION
BEGINNING OF OPERATION 1978

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979		11		28		2.4		7.0
1980		L11		43		3.7		8.6
1981		L11		37		3.0		4.7
1982	250	12	156	20	9.3	3.7	43.0	6.2
*	250	11	156	37	9.3	3.7	43.0	7

* Valeurs médianes obtenues les 3 dernières annees.
Median values obtained over the past 3 years.

WATER SUPPLY: There is no public water system in the Village of Cap Pélé. Private wells which average 8 m to 30 m in depth supply the village's water needs.

WATER QUALITY: The water quality of the area's wells is described as "fair" by the village manager who suggests that well contamination may exist. Nine wells, drilled in 1981, in the church and town centre area of the village have been contaminated by petroleum from the nearby gas station. No other specific instances of pollution have been identified. Lower Cap Pele is the sector of the village where the potential for groundwater pollution is greatest.

WASTEWATER: The present sanitary sewer system, was constructed in 1978 and services the core area of the village. The total number of units serviced, including institution and commercial connections is approximately 350. Of this number, 237 are residential dwellings in the village. All wastewater is treated in a 3.2 ha. lagoon. The effluent from the lagoon discharges into Friel Brook, which in turn discharges into the Northumberland Strait. In 1984, an extension of sewer services was completed. A new lift station was also installed and services 83 users.

Originally designed as a 2 ha. facility, the lagoon was expanded to accommodate flows from local fish processing operations. The design loading capacity of the treatment plant can accommodate the population equivalent of approximately 1,600 people. Cape Bald Packers, a fish processor, is hooked into the village's sewer system and contributes a BOD loading of 457 lbs per day during a 15 hour operation (Spear, MacDonald & Assoc. Ltd., 1982).

In the late summer and early fall of 1981, a 20 hp mechanical aerator was installed. This resulted in a marginal effluent quality improvement and apparently eliminated the odor problem from fish processing waste. The aeration of wastewater in the village lagoon during the time of peak processing has been a successful practice in treating the BOD loading contributed by the fish processing industry. However, the full treatment of all brine effluent cannot be assured and the possibility of groundwater contamination exists.

The strong dependency on the East Coast fishery is likely to continue to be the community's main economic base. An expansion of the fish processing industry could contribute to increased peak loadings on existing waste treatment lagoons. Two servicing alternatives to complete the sewage collection and waste treatment program which will include all of the municipality of Cap Pélé are presented in "Feasibility Study on Sewer System Extensions" (1982) by Spear, MacDonald and Assoc. Ltd.

A problem which appears to be specific to this community is the proliferation of individual (private) smoke houses within the municipal boundary. A municipal plan passed by the village council in November 1982 is meant to control the location of these structures in the future. Most smoke houses are located along the coastline and process water, which is 100% brine, is eventually discharged into the ocean.

Portions of the municipality are serviced by separate storm and sewer lines. Table (3.4) summarizes the operation conditions of the village's waste water treatment plant.

The area's excellent natural coastline and beach areas suggest that an expanded role could be played by tourism in the future economic development of the village. This would increase the seasonal demand for water supply and waste treatment facilities.

FIRE PROTECTION: Fire protection within the Village of Cap Pélé is not a municipal responsibility and is provided by a private company, although they are called the Cap Pele Fire Department. They are equipped with a 2250 litre and a 6750 litre tanker.

3.5 The Town of Dieppe

The Town of Dieppe is situated within the boundaries of two parishes in Westmorland County, Moncton Parish and Dorchester Parish. Dieppe is located on the eastern bank of the Petitcodiac River and is bounded on the north by the City of Moncton, on the east by the Trans Canada Highway and on the south by the community of Upper Dover.

Located within the Greater Moncton Metropolitan Area, the municipality encompasses approximately 4,900 hectares of gently rolling hills which border on flatter land near the Petitcodiac River. Elevations within the town boundaries vary from 72 metres in the northeast corner to 9 metres near the Petitcodiac River. Several small streams cross the region to discharge into the Petitcodiac River. The largest stream, Fox Creek, has a drainage area of 29 km^2.

Residential development, mainly along Route 6, accounts for 37% of the total land area; rural or park land, 30%; industrial use, 20%;and commerical use 13%. Dieppe has the characteristics of a commercial and industrial center. The commercial area has developed around the Champlain Mall near Halls Creek and the industrial Park is situated near the airport and major highways. The proportion of serviced land to total land use in the Town of Dieppe is in the order of 35% (Boyd H. Touchie Engineering Ltd, 1983). The population is 60% French speaking. Dieppe was incorporated as a village in 1946 and gained its town status in 1952.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Cap Pélé

TABLE (3.4)

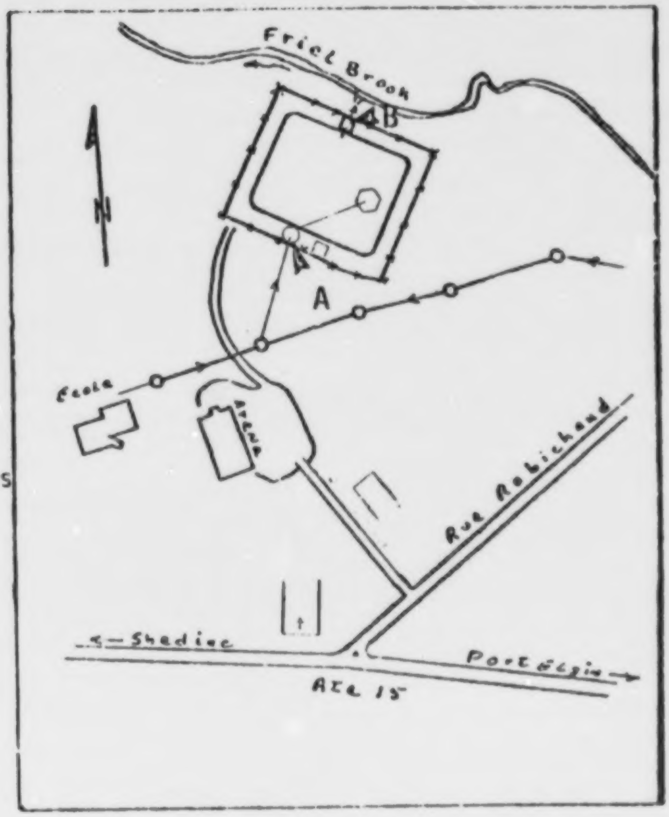
POPULATION 2,287

SURFACE DU BASSIN
POND AREA 2.0

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 40.5

MISE EN OPERATION
BEGINNING OF OPERATION 1978

INDUSTRIES MAJEURES
MAJOR INDUSTRIES Cape Bald Packers



Valeurs médianes obtenus
Median values obtained

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/l)	EFFLUENT SORTIE (mg/l)	INFLUENT ENTREE (mg/l)	EFFLUENT SORTIE (mg/l)	INFLUENT ENTREE (mg/l)	EFFLUENT SORTIE (mg/l)	INFLUENT ENTREE (mg/l)	EFFLUENT SORTIE (mg/l)
1979	170	13	220	30	10.6	1.9	44.0	7.1
1980	205	38	200	81	9.5	5.7	64.5	32.5
1981	380	88	190	86	13.5	4.8	65.7	24.4
1982	280	37	113	32	11.9	4.7	82.5	30.0
*	265	35	150	81	11.7	5.0	78.0	25.0

* Valeurs mediane obtenues les 3 dernieres années.
Median values obtained over the past 3 years.

POPULATION: The 1981 census population of Dieppe was 8,511. This is an increase of 1,050 (14%) over the 1976 population count of 7,460. A steady growth trend is predicted in Dieppe. The town has 2.525 occupied dwellings.

YEAR	CENSUS POPULATION
1951	3,402
1961	4,032
1966	3,847
1971	4,277
1976	7,460
1981	8,511

WATER SUPPLY: The Town of Dieppe secures its water supply from the City of Moncton. This surface supply, Turtle Creek, supplies an average water demand of 122.7 million litres a month of 4.1 million litres per day. (Superintendent of Works). Considering a resident population of 8,511 in 1981 and the fact that the community has no major industrial users, the average per capita water demand in the Town of Dieppe is calculated to be somewhat less than 480 litres/capita/day. The water supplied to the town is metered at the source of supply. There are serviced connections to approximately a dozen industrial and commercial establishments which are metered. The Airport and a potato processing company, F.F. Enterprise, are the major water users in Dieppe.

An elevated storage tank, located in the Dieppe Industrial Park, has a holding capacity of 2.84 million litres, and an outlet pressure of 5.98 kg/cm2. The minimum and maximum pressures within the distribution system vary from 2.46 kg/cm2 to 8.44 kg/cm2. The maximum pressure under gravity in distirbution lines near the Petitcodiac River is 5.62 kg/cm2.

WATER QUALITY: The colour and turbidity of the town's water supply affects the water quality. Water temperatures and the amount of chlorine used in the treatment process is also objectionable to some consumers.

HYDROGEOLOGY: The lack of an adequate source of surface water supply within the town's boundaries, combined with the expected substantial increase in purchasing cost of Moncton water prompted the Town of Dieppe in 1981 to retain a consultant (Boyd A. Touchie Consultants Ltd.) to study the feasibility of a new water source for the municipality. The following discussion is extracted from that report:

> Groundwater levels vary considerably throughout the area and depend not only on the proximity to a recharge area but also to the underlying geology and the number and depth of aquifers penetrated. Generally speaking, the water table lies close to the ground surface.
>
> Generalized flow directions can be expected to move water from dominent geologic hills of the Kingston uplift (Lutes Mountain) towards the Petitcodiac River. Local flow patterns will be superimposed upon this general trend. The direction of flow is towards the southeast.
>
> Water occurs at varying depths in the area. Reviews of available data indicate that these depths range from 6 m to 60 m below ground surface. Yields are generally low throughout the area with wells averaging 0.3 l/sec. The highest recovered yields are adjacent to the northern boundary of the town near the old Shediac Road and around the Moncton Airport.
>
> Transmissivities in the bedrock vary from 18.2 to 66.0 m2/day for the Salisbury Formation while those for the Richibucto Formation are considerably higher at 342.3 to 1682.2 m2/day.
>
> The rocks underlying the Dieppe area do not normally yield water in the quantities needed to serve such a large population base. In general, yields of 0.3 l/sec, surficient for a single family dwelling, are usually found. There is an area along the Shediac Road where yields of 5.3 l/sec are recorded. Greater quantities of water may still be available at depth.
>
> A well with a capcity of 5.4 l/sec is reported to be available at the Moncton Airport and one of two wells owned by Keddy Motel also has a capacity that approaches 5.2 l/s. The highest yielding wells in the area are found in what was once known as the Village of Lewisville, now a part of the City of Moncton.
>
> The area adjacent to and bordering the northern boundary of the municipality, from available information, appears to have good potential to produce a water supply of sufficient quantity to meet the needs to the Town of Dieppe. Generally speaking, the water quality is acceptable.

WASTEWATER SYSTEM: The Town of Dieppe does not have a municipal wastewater treatment system. A sewwage collection system with both separate and combined sanitary and storm drains, services all but 100 or so dwellings. Those excluded are located in the Dover Road area. The sewer drains outlet to the Petitcodiac River at various locations. There are eleven outfalls.

A predesign wastewater flow study for the Town of Dieppe was done by Acadia Consultants and INspectors Ltd., in 1981. The consultants estimated the present average daily waste water flow to be 10 milion litres/day. Future average daily flows for the year 1996 was estimated to be 12 million litres/day and 16.6 milion litres/day for an ultimate population (beyond 2,000). Extraneous flows at some outfalls now represent a significant portion of wastewater flows with the present average flows estimated to be 2.7 times standard design allowances. The consultants observed that river water was backing up into the sewer system during high tide because of improperly functioning flat gates on most outfalls. Effluent characteristics are shown on Table (3.5).

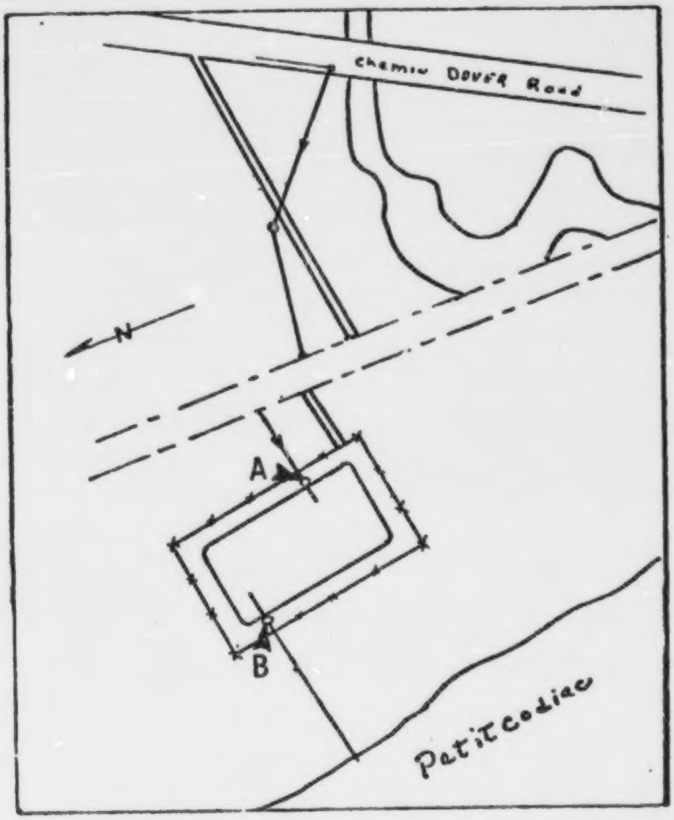
In January 1982, the City of Moncton Council authorized Boyd A. Touchie Engineering Ltd. of Moncton, New Brunswick, to assess the collection and treatment alternatives available in order to meet the regulation set by Environment New Brunswick for the discharge of treated sewerage to the river. The Town of Dieppe, in order to have the same design data base information authorized the study team to submit a Letter Report to the Council detailing the town's options for an alternative of collection and treatment system. Refer to this report entitled "Pre Design Engineering Report for the Greater Moncton Area Sanitary Sewage Collection and Treatment System" for details of the joint collection and treatment system for the Greater Metrolpolitian Area. In 1982 a tri-commission was formed by the municipalities of Moncton, Riverview and Dieppe to consider the adoption and implementation of the Pre-Design Engineering Report.

FIRE PROECTION: The Town of Dieppe has 398 hydrants. They also have one pumper tanker (5400) litres and two pumper trucks (each with a capacity of 2250 litres); although, as of December 1984, one was out of service.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Dieppe

TABLE (3.5)



POPULATION 7,460

SURFACE DU BASSIN
POND AREA 0.8

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 13.5

MISE EN OPERATION
BEGINNING OF OPERATION 1976

INDUSTRIES MAJEURES
MAJOR INDUSTRIES

Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	17	L10	175	95	2.4	L0.2	10.8	1.6
1980								
1981								
1982	29	-	155	-	5.7	-	30.5	-
*	29	-	155	-	5.7	-	30.5	-

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

FLOODING: Poor surface drainage in the Champlain (mall) Place, which is located on a marshland, have caused backup flooding. However, new drain lines have been installed and this problem has been corrected.

Ice jamming has occurred at Fox Street Bridge causing damage to the bridge there. This problem has also been corrected by the construction of a new bridge with a larger waterway opening.

3.6 The Village of Dorchester

LOCATION AND PROFILE: Dorchester is one of a dozen or more communities situated in the Memramcook Valley in the southeast of the Province of New Brunswick. Located in Dorchester Parish, Westmorland County at latitude 45° 54' North and longitude 64° 31' West, this municipality is 25 km from Moncton ad 10 km from Sackville. The municipality incorporates approximately 5.4 km2 of land area and is connected to the Trans Canada Highway by Route 6. The elevation within the village limits varies from 6 m to 76 m above level.

A ribbon and zone development has occurred on the existing highways within this municipality. Dorchester has a core with residential development occurring on all roads leading away from the village centre. The Dorchester Penitentiary, built in 1882, sits on a large knoll to the north of the village. Most community facilities and recreational areas are located near the central part of the community.

Eleven percent (11.2%) of the village's land space is devoted to residential and commercial development. Today, fifty-three (53%) of Dorchester's total land area is developed agricultural land (this includes the prison farm).

The west side of the village is dyked and drained marshland and represents the best agricultural land in the vicinity of the village. The potential for commercial forests in the area is limited by soil conditions. The federal penitentiary is the only major employer in the area. Dorchester was incorporated as a town in 1911 and reincorporated as a village in 1966.

POPULATION: At a time when rock quarrying and ship building were at their height in the middle 1800's, the village of Dorchester boasted a population of 3,284. The population trend in the Village of Dorchester is one of decline over the past decade. Statistics Canada, Census of Canada, records the total population of the

Village of Dorchester in 1981 as 1,101. The village has 226 occupied dwellings. The census data is shown below:

YEAR	POPULATION
1971	1,119
1976	1,125 (720 non-institutional)
1981	1,101

Although the non-institutional population is forecasted to remain within the 700-800 people range (N.B. Department of Municipal Affairs, 1981) growth is expected to be related to the number of jobs created in the surrounding district, including the Greater Metropolitan Moncton Area. The change in composition of the population in Dorchester show that the village population is disportionally heavy with older people (Census of Canada Records). This is a factor in influencing the specific needs of the community for service facilities.

GEOLOGY: The municipality of Dorchester is perched over the contact region between two major carboniferous sedimentary rock units, the Boss Point Formation and the Enrage Formation, located between Main Street and Woodlawn Street. The beds dip from 25° to 45° to the southeast. The bedrock is mostly at or near the surface and is veneered by till, mostly clayey soil and silty sand, generally less than 2 m thick. The more fertile agricultural soils are formed on tills derived from the softer, feldspar and clay-rich Enrage Formation northwest of the northeast trending ridge. Alluvial deposits composed of sandy silt and sandy gravel occur in narrow bands along several small streams (Ruitenberg, A.A. and Thibault, J., 1981).

HYDROGEOLOGY: The best aquifers in the village are situated in lightly fractured sandstone and conglomerate of the Boss Point Formation immediately above the impermeable shale unit comprising the uppermost Enrage Formation. The Enrage Formation is notably poor for the supply of groundwater.

The Village of Dorchester has access to an abundant supply of groundwater. Most wells tested in the area yielded between 227 and 910 litres per minute, at depths between about 45 to 165 metres. Private wells yield about 27 litres per minute at a depth of approximately 24 metres. All these wells are in highly fractured Boss Point sandstone or conglomerate.

The abundant groundwater supply in the Boss Point is highly vulnerable to pollution, especially that water found immediately east of the Enrage-Bosse Point contact. Generally speaking, this area is covered by a thin till veneer that has little filtering capacity for pollutants (Ruitenberg, A.A., and Thibault, J., 1981).

WATER SUPPLY: In the late 1950's shallow wells in the Village of Dorchester became contaminated by local septic systems with the result that cases of typhoid were isolated within the village. A study commissioned by the Minister of the Environment for the purpose of securing a safe, adequate municipal water supply was conducted in 1975. Exploration wells were drilled in the Boss Point Formation. Because of the presence of salt domes in the vicinity or perhaps because of the tidal influence in the Dorchester area, some test wells were salt contaminated. In 1977, two good wells, one located along Woodlawn Street, the other located at the intersection of Water Street and Highway #6 were secured, Figure (3.3). These wells together are able to produce over 15 litres per second.

These two wells, one supply and one back up, now service a population of 1,101 in the Village of Dorchester. There are 244 service connections of which 65% of the total demand flow is to residential dwellings. All dwellings, with the exception of the Penitentiary and Guard House Row in the village are included in the water distribution system. The average water demand of the village is 23-25 litres per minute. The maximum demand is approximately 30 litres per minute.

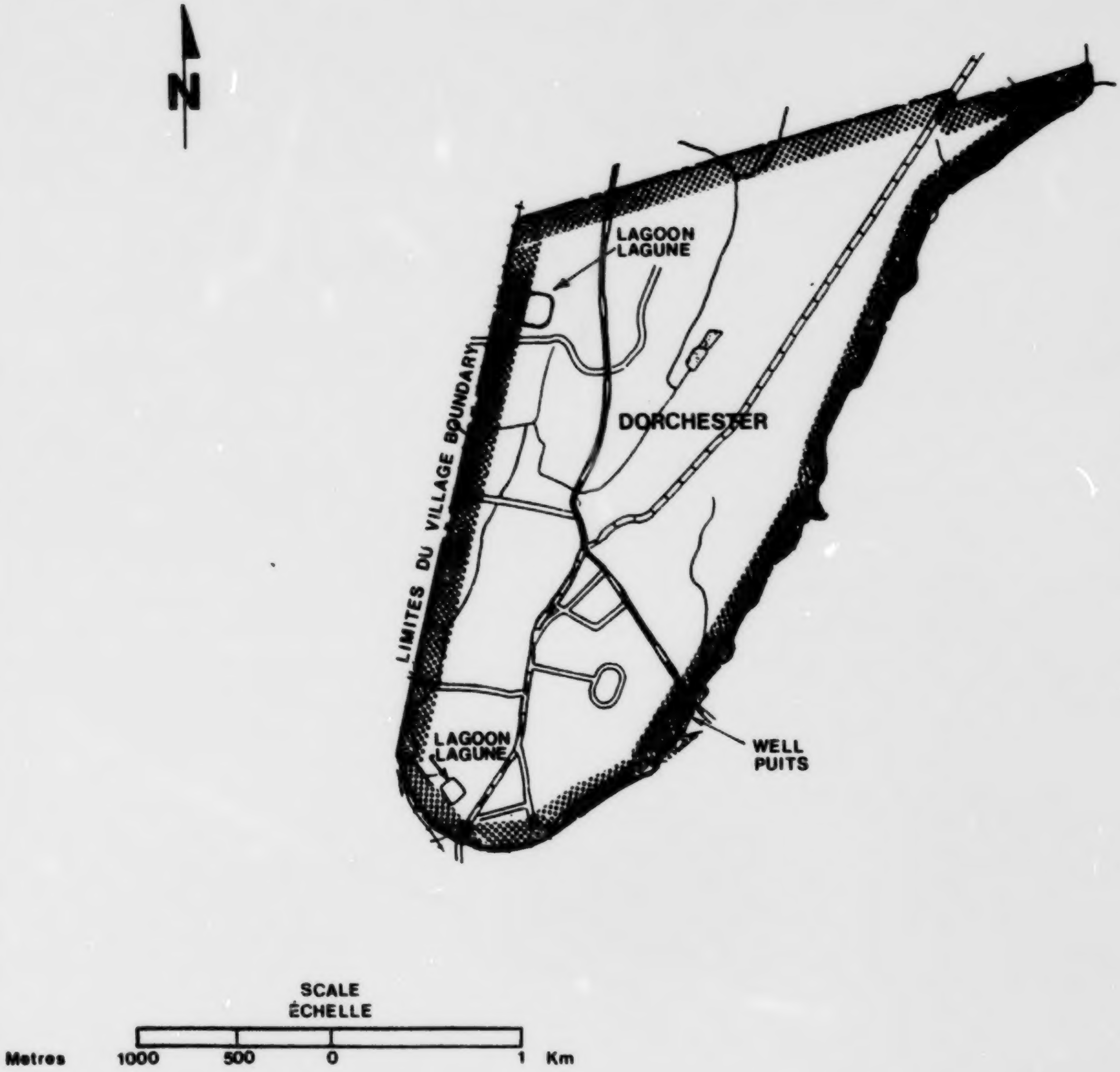
The water distribution system (designed W.H. Crandall & Assoc.) is a hydro-pneumatic one similar to that found in most private water systems. The village has experienced mechanical problems with this pumping system. As well, the far end of Woodlawn Avenue had low pressure problems in that section of the distribution system. However, these problems have been corrected with repairs made to the pump.

The municipal supply is adequate for the present and future needs of the village except in the event of a medium security institution being constructed in the immediate area.

WATER QUALITY: The water quality of Dorchester's public supply is described as "hard" by village officials. Chemical analysis of water secured from each well was done in the summer of 1982 by the Department of ENvironment. Manganese in Well #1 (0.47 mg/l) was in excess of the maximum acceptable limits based on the guidelines for Canadian Drinking Water Quality, 1978. The pH (8.61) and iron content (0.67 mg/l) of water secured from Well #2 (Water Street) also exceeded these limits, see Table (3.6). The limits imposed for manganese, iron and pH are based on aesthetic considerations and exceeding these limits is not a serious concern unles the village's water is consistently of a quality objectionable to the consumer. Refer to Section (2.1.3.2) for a discussion of the consequences of excessive mineral concentration in a groundwater supply.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSOURCES EN EAU


N
LAGOON
LAGUNE
DORCHESTER
LIMITES DU VILLAGE BOUNDARY
WELL
PUITS
LAGOON
LAGUNE
SCALE
ÉCHELLE
Metres
1000
500
0
1
Km

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

WATER SOURCES
DORCHESTER
SOURCES D'EAU

FIG. 3.3

TABLE (3.6) WATER QUALITY OF WELLS IN THE VILLAGE OF DORCHESTER (AUG., 1982)

CHEMICAL TEST	UNITS	WOODLAWN AVE. WELL#1	WATER ST. WELL #2	VILLAGE HALL WATER	MAXIMUM ACCEPTABLE LIMITS (CDWS, 1978)
Potassium	MG/L	1.6	1.6	1.5	
Calcium	MG/L	25.	4.6	24.	200.
Flouride	MG/L	L.1	L.1	L.1	1.5
Sulfate	MG/L	91.	11.	12.	500.
Nitrate	MG/L	240.	L.01	L.01	10.
Alkalinity	MG/L	7.57	73.	89.	30 to 500
Conductivity	US/CM	240.	260.	230.	
PH	PH UNITS	7.57	*8.61	7.52	6.5 to 8.5
Turbidity	NTU	.14	2.4	.13	5.0
Nitrite	MG/L	L.01	L.01	L.01	1.0
Sodium	MG/L	11.	30.	8.8	270.
Iron	MG/L	.06	*.67	.05	.3
Manganese	MG/L	*.47	.03	*.32	.05
Copper	MG/L	L.01	L.01	.07	1.0
Lead	MG/L	L.05	L.05	L.05	.05
Zinc	MG/L	L.01	L.01	.01	5.

Source: Water Resources Branch, N.B. Department of the Environment

*Indicates Greater Than Acceptable Level

L indicates "LESS THAN"

CDWS: Canadian Drinking Water Standard

TABLE (3.6)cont.

CHEMICAL TEST	UNITS	WOODLAWN AVE. WELL #1	WATER ST. WELL#2	VILLAGE HALL WATER	MAXIMUM ACCEPTABLE LIMITS (CDWS, 1978)
Aluminum	MG/L	L.1	L.1	L.1	
Chloride	MG/L	11.	31.	9.9	250.
Silica	MG/L	14.	2.3	14.	
Magnesium	MG/L	6.3	4.4	6.2	150.
Hardness	EPM	88.362	29.601	85.453	

All existing and future wells drilled in the west portion of the village should consider the possibility of potential copper-uranium deposits in the basal Boss Point Formation. Since such deposits could locally severely affect the groundwater quality, future wells drilled in this area should be tested for these water quality indicators.

A large salt dome capped by anhydrite and gypsum exists immediately west of the village boundary. Care should be taken in the event of future drilling and possible use of solution cavities for storage of oil, natural gas, etc., that does not lead to the contamination of the groundwater in the area. (Ruitenberg, A.A. and Tibault, J., 1981).

WASTEWATER SYSTEMS: A 3.24 hectare lagoon with the capacity to service the needs of 2,000 people is located in the southwest area of the village. All dwelling units within the village boundaries are connected to the sewer system. Separate sanitary and storm sewer lines are found throughout the municipality. The collection system is mainly gravity type mains, with one lift station located at Route 16 and Water Street. This water treatment facility is adequate for sometime in the future. Effluent characteristics are shown on Table (3.7).

The penitentiary has its own waste treatment facility located behind Guard House Row. The waste stabilization pond is 2.51 hectares and has a design capacity of 1,240 persons.

FIRE PROTECTION: Water Storage for fire protection is an underground reservoir connected to the water system. The village has 48 hydrants.

FLOODING: The Village of Dorchester is located adjacent to a flood plain. Storm sewer outfalls, drainage canals and levees have been built in the plain and flood events are unusual. There is little development on the flood plain area. During two recorded flood events, September 1932 and March-april 1962, there was reported damage to bridges crossing the Memramcook River (Environment Canada, 1976).

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE / MUNICIPALITY: Dorchester

TABLE (3.7)

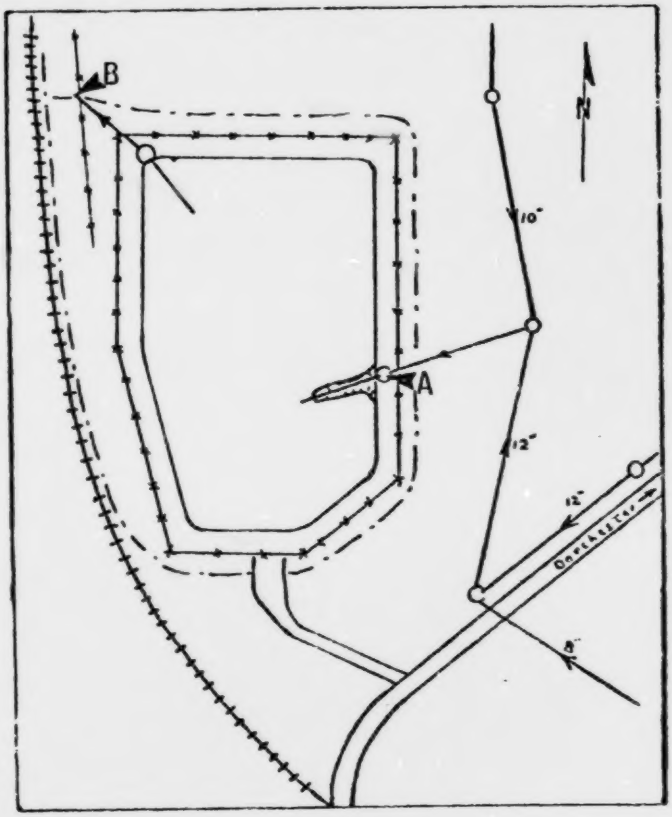
POPULATION 1,125

SURFACE DU BASSIN / POND AREA 3.2

CHARGE KG/HECTARE/JOUR / LOADING KG/HECTARE/DAY 26.5

MISE EN OPERATION / BEGINNING OF OPERATION 1977

INDUSTRIES MAJEURES / MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	69	L10	74	L10	3.3	0.5	33.5	3.4
1980		L10		27		1.6		9.7
1981		L10		21		0.9		3.1
1982	-	L10	-	L10	-	1.3	-	5.8
*	272	L10	213	19	3.3	1.5	20.5	4.5

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

3.7 The Village of Hillsborough

LOCATION: The Village of Hillsborough is located near the mouth of the Petitcodiac River, in the Parish of Hillsborough, Westmorland County. Situated between Moncton and Fundy Park on Highway 114, it is 22 km south of Moncton, 19 km south of Riverview and 61 km northeast of Fundy National Park.

The village encompasses a total of 1,311 ha. of land a which 296 ha. are marshland. This is low lying land east of the railway tracks and parallel to the Petitcodiac River. Land elevation within the village varies considerably from 4.6 m near the banks of the Petitcodiac River to 76 m in the northwestern portion of the village. Hillsborough was incorporated in 1966.

POPULATION: The village of Hillsborough has experienced slight growth during the past decade (1971-1981). In 1981, the census population was recorded at 1,239 in 397 occupied dwellings. The economic base of the Village of Hillsborough has been provided by Canadian Gypsum Co. Ltd., manufacturer of wallboard and plaster (This business has ceased operating). It seems that any population growth projections for Hillsborough would have to be made in light of growth of the Moncton city area.

YEAR	CENSUS POPULATION
1971	1,050
1976	1,153
1981	1,239

WATER SUPPLY: At the present time, Hillsborough has no public water supply. Private wells, which vary in depth from 18 m to 90 m, provide for the village's water needs. The wells in the Lakeview Crescent area are overflow wells.

WATER QUALITY: The water quality from private wells in the Village of Hillsborough is variable. There are complaints of bad taste and odor from wells supplying the post office, Baptist Church and Memorial Hall, all of which are located along Main Street (Route 114). The water in wells along that section of Main Street between Pleasant Street and Legion Street (approximately) has in the summer of 1982 acquired a "bad" taste. Village Officials suggest this situation is worsening and more wells located south along Route 114 are becoming affected. In February, 1981, a spill of heating oil contaminated the Hillsborough Hill School ground supply. The old Junior High well has replaced the contaminated supply.

Hillsborough has had a history of isolated well contamination. A service station is suspected of being the source of petroleum contamination of wells between Academy and Pleasant Street. The Department of Health closed down Peterson's Rest Home due to petroleum contamination of the well.

WASTEWATER SYSTEM: An 3.2 hectare lagoon located in the Marsh area north of Gray Brook and west of the Canadian National Railway, receives the sewage waste of all but 100 homes in Hillsborough. Servicing in the north of the village along Route 114 does not extend to Salem Road. There is one lift station needed to service the developed area south of Grey Brook.

Storm and sanitary drainage is separate in areas which are serviced. See Table (3.8) for data relating to the operating conditions at the waste water treatment plant. In the autumn of 1984, a contract for the construction of sanitary sewers for the north system was approved with construction to begin in 1985.

FIRE PROTECTION: The village's fire supply well is located north of Academy Street and is 100 m deep with a 20 cm casing. The well pumps at 25 l/m. A ground level storage tank (capacity 0.13 million litres) secures the supply. There is one hydrant.

3.8 The City of Moncton

The City of Moncton is situated on the north side of the Petitcodiac River in the Parish of Moncton, Westmorland County. The city is located approximately 32 km from Northumberland Strait and 48 km from Chignecto Bay.

The transportation and communications industries together with the service and trade industries are the region's main employers. Always a transportation centre, Moncton today is a distribution centre for Atlantic Canada and is often referred to as the "Hub of the Maritimes". Moncton gained city status in 1890.

TOPOGRAPHY & GEOLOGY: Moncton is situated on a plain which varies from about 8 m to 46 m. Low land ranges in elevation from 8 m to 15 m above sea level. The surrounding land is generally between 30 m to 46 m. The highest elevation in the Moncton area is the airport - 70 metres.

The Moncton area is one of the maximum marine overlap and rocks are sedimentary by type. The plain is covered with a thin veneer of glacial drift which is underlain by the nearby flat-lying sandstones, shales and conglomerates of the Pennsylvanian Period (Montreal Engineering Co. Ltd., 1969).

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE / MUNICIPALITY Hillsborough

TABLE (3.8)

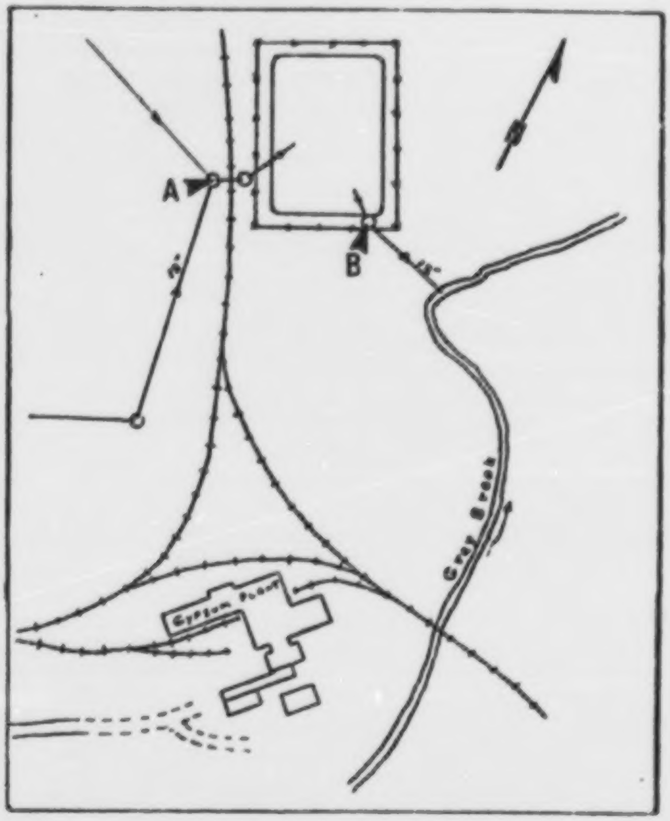
POPULATION 1,153

SURFACE DU BASSIN / POND AREA 3.2

CHARGE Kg/HECTARE/JOUR / LOADING Kg/HECTARE/DAY 25.5

MISE EN OPERATION / BEGINNING OF OPERATION 1975

INDUSTRIES MAJEURES / MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	148	L11	183		7.6		46.5	
1980		L10		54		2.3		
1981		L10		14		4.5		10.3
1982	90	L10	52	L10	4.0	2.4	29.0	2.8
*	90	L10	130	14	4.0	2.8	23.0	5.4

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

POPULATION: The City of Moncton has shown a steady trend of increasing population growth over the past century. Only between census years 1976 and 1981 was there a decrease (2%) in population count. The population growth of Moncton has traditionally exceeded that of the provincial average. In 1981, there were 54,743 individuals living in the City of Moncton. There were 19,402 occupied dwelings.

YEAR	CENSUS POPULATION
1881	5.032
1891	8,762
1901	9,026
1911	11,345
1921	17,483
1931	20,689
1941	22,763
1951	27.334
1961	43,840
1966	45.847
1971	47.891
1976	55,934
1981	54,743

WATER SUPPLY: The City of Moncton secures its water supply from Turtle Creek Reservoir. Constructed in 1966 to replace the McLaughlin Road Reservoir and the Irishtown Reservoir, this surface supply, with a catchment area of 170 sq. km, has a storage capacity of 6,538 m^3 and a design flow of 136 million litres per day. One elevated storage tank has a total capacity of 6.3 million litres and two below ground level storage tanks have a capacity totalling 27 million litres.

The average total water demand in the City of Moncton is 46 million litres/day with a maximum total demand of 61 million litres/day. Approximately 67% of the total water demand is to residential dwellings, 15% (estimated) to satisfy commercial needs, 15% (estimated) to industrial users and 3% (estimated) for institutional use (Director of Utilities and Sanitation, City of Moncton). A breakdown of the 1981 water demands is shown below:

1981 Census Population	54,743
Total Water Demand	46 million litres/day
Commercial-Industrial	15 million litres/day
Residential Water Demand	32 million litres/day
Per capita demand	585 litres/capita/day

The largest commercial users in Moncton during the year 1981 were Brunswick Bottling (51 MG); C.N.R> (83 MG); Combustion Engineering (25 MG); Fiberglass Canada (27.5 MG); not operating at present; Hub Meat Packers (28.0 MG); and Maritime & Chrystal Beverages (22MG). The University of Moncton accounted for 31.0 MG of total amount supplied by the City of Moncton. The relationship between the population and water use is shown on Table (3.9) and Figure (3.4).

WATER QUALITY: The water quality of the municipal supply from the Turtle Creek Reservoir in Moncton is generally satisfactory. This surface supply receives chlorination and floridation treatment before being distributed to the greater metropolitan Moncton area and the water quality meets the guidelines set by the Canadian Drinking Water Quality Standards, 1978.

The natural quality of the surface water in the reservoir directly affects the water quality in the distribution system of the city, however. During periods of high surface runoff in the Turtle Creek watershed, usually 15 to 20 days of the year, silt-laden water enters the reservoir and the impounded water is subjected to wide variations in colour and turbidity due to hydrologic and seasonal conditions. The quality of the water is also likely to deteriorate aesthetically, i.e. in taste, colour or odor, when water levels in the reservoir are at a minimum, usually during the summer months. Colour in water may be of natural mineral or vegetable origin, such as iron and manganese compounds; humus materials, peat, tannis, algae, weeds and protozoa. High levels of turbidity are the result of periodic loads of materials input to the reservoir by runoff.

The water in Turtle Creek Reservoir has a pH (6.4) slightly below the acceptable lower limits of (6.5) and is low in alkalinity (14 mg/l as $CaCO_3$). Recent pH tests show a reading of 6.6

The Moncton water supply tends to be corrosive as well, dissolving existing deposits of calcium carbonate on interior piping in the distribution system and producing "red water". Lime may have to be added to neutralize the water supply; but the problem has not yet reached that stage. Chemical analysis results of the water supply is shown in Table (3.10).

WASTEWATER TREATMENT: The City of Moncton is not served by a municipal waste water treatment facility. The city has used a system of collectors to direct outflows to the Petitcodiac River and its various tributary streams in the immediate area. Seventy-nine (79%) percent of the city's collection system is combined (mainly in downtown area). Approximately 18% of system

TABLE 3.9 POPULATION AND WATER DEMAND

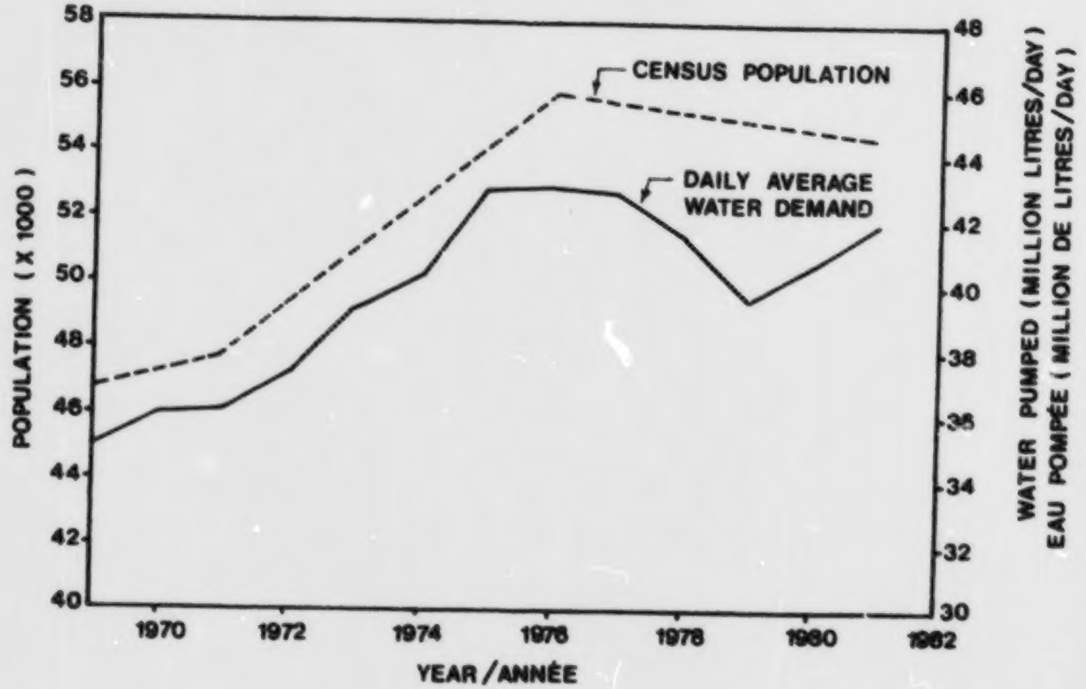
CITY OF MONCTON

Year	Population	Total Water Pumped million/litres	Daily Average demand million/litres/day	Percentage Yearly Increase (Decrease)
1981	54,743	16,808	46.0	5
1980		15,935	43.7	5
1979		15,145	41.5	9
1978		16,453	45.1	-6
1977		17,456	47.8	-<1
1976	55,934	17,522	48.0	0
1975		17,507	48.0	12
1974		15,486	42.4	4
1973		14,909	40.8	10
1972		13,372	36.5	7
1971	47,891	12,522	34.3	1
1970		12,407	33.9	6
1969		11,707	32.1	3
1966	45,847	-	-	-

SOURCE: City Records

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSOURCES EN EAU



MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

POPULATION AND WATER PUMPED
MONCTON
POPULATION ET EAU POMPÉE

FIG. 3.4

TABLE (3.10)CHEMICAL ANALYSIS, AUGUST, 1982

PUMPING STATION INLET-MONCTON

		MAXIMUM ACCEPTABLE	LIMIT
CHEMICAL TEST	RESULTS	CONCENTRATION	UNITS
Potassium	.5	----	MG/L
Calcium	4.4	200.	MG/L
Flouride	L.10	1.5	MG/L
Sulfate	3.1	500.	MG/L
Nitrate-Nitrite	.01	10.	MG/L
Alkalinity	14.	30 to 500	MG/L
Conductivity	55.	----	US/CM
pH	6.4	6.5 to 8.5	PH UNITS
Turbidity	.46	5.0	MG/L
Nitrite	L.01	1.0	MG/L
Sodium	2.4	270.	MG/L
Iron	.11	0.3	MG/L
Manganese	.05	0.05	MG/L
Copper	L.01	1.0	MG/L
Lead	L.05	0.05	MG/L
Zinc	.04	5.0	MG/L
Aluminum	L.10	----	MG/L
Chloride	L5	250.	MG/L
Silica	5.3	----	MG/L
Magnesium	.79	150	MG/L
Hardness	14.239	120	MG/L

is separated sanitary and storm drainage and was installed in 1963, the remaining 3% of the city's distributed system is sanitary collection only (Director of Utilities and Sanitation for Moncton.

The City of Moncton presently has a total of 23 outfalls discharging into the Petitcodiac River. With the construction of the causeway in 1968 between the west end of Moncton and the Town of Riverview the flushing action of the tidal Petitcodiac River was greatly reduced and silt deposition has filled the former river channels and the mouths of tributary streams. The creation of wide flats of silt deposits separated manyoutfalls from the new river channel, thus causing health hazards, odors and unsightliness.

Wastewater treatment is required to meet provincial regulations and the City of Moncton, together with the Town of Riverview and the Town of Dieppe, authorized consultants in January, 1982 to conduct an assessment of treatment alternatives available to the City of Monacton.

The following evaluation of the existing and proposed system is extracted from the pre-design engineering report prepared by B.A. Touchie Engineering and Anderson Associates Limited in March, 1983.

Flow monitoring results:

Design flow rates-Residential: 0.30 m^{3}3 capita/day
Design flow rates-Commercial: 17 m^3/Ha/day
Design flow rates-Industrial: 42 m^3/Ha/day
Infiltration in the existing system: 11 m^3/Ha/day

Based on the results of a sampling and analysis program the average raw sewage vlaues are in the order of 100 mg/l for BOD and 75 mg/l for suspended solids.

Total average daily dry weather flows:

Existing: 68,674 m^3/day (supplying population of 54,743)
20 year: 97,016 m^3/day (supplying projected population of 66,795
Proposed treatment plant will be designed to treat 97,106 m^3/day.

FLOODING: The City of Moncton is situated on a low lying plain. Elevations near the river are 8 metres above mean sea level. Generally, any land less than 10 m above sea level in Moncton area is susceptible to flooding. The Petitcodiac River is tidal and significant flooding may occur during times of extreme high tide which coincide with periods of heavy rainfall.

This was the case in October of 1969, an event which is referred to as the great "Saxby Gale". The resulting flood damaged property along the Petitcodiac River and its tributaries in the Moncton area. A house on Church Street had a reported depth of water of 1.5 m in the main floor (Inland Waters Directorate, Environment Canada, 1976).

During the flood of March 31 to April 4, 1962, a record 109 mm of rain fell at Moncton during a 24 hour period (previous high was 100 mm in September 1940). The flooding which occurred in the Moncton area was said to be the heaviest in memory. West Main STreet was "submerged", with ice damage to parked cars. Residents were forced to evacuate homes on New Street. A bridge on Royal Boulevard over Johnathan Creek was submerged. (Inland Waters Directorate, Environment Canada, 1976).

3.9 The Village of Petitcodiac

The Village of Petitcodiac is located at the junction of the Anagance River and the North River in Salisbury Parish, Westmorland County. It is approximately 40 km west of Moncton and 37 km east of Sussex. The village is located at 45° 56' north latitude and longitude 65° 10' west and is 29 m above sea level. The municipality covers an area of 1,694 ha. The village is divided into three sections by the Trans Canada Highway and the Petitcodiac River. Access to the village from Sussex and Moncton is provided via Route 2. Access to the municipality from Havelock and Cornhill is provided via Route 885 and 890 respectively.

The village serves as a service centre for the immediate area because of its semi-rural environment and proximity to the City of Moncton. It is developing as a dormitory community for the larger community. Forest product industries such as Fawcett Enterprise Ltd., a lumber cutting and sawmill operation, constitute the economic base of the community. Petitcodiac was incorporated as a village in 1966.

TOPOGRAPHY & GEOLOGY: The village is located on gently sloping land ranging from a low of about 22m near the lagoon location to a high of about 49 m in the area south of the Trans Canada Highway near Elgin Road. The slope is downward from the Trans Canada Highway towards the Petitcodiac River and never exceeds 8%.

The village of Petitcodiac is located within the Petitcodiac geological group composed of sedimentary rocks, grey sandstone, shale and conglomerates.

Generally speaking, soil conditions within the village are good for agricultural purposes.

POPULATION: The census population of the Village of Petittcodiac in 1981 was 1,401 persons occupying 493 dwellings.

YEAR	CENSUS POPULATION
1971	1,131[1]
1976[2]	1,472
1981	1.401

[1] Based on boundaries as of June 1, 1976

[2] Boundary changes from preceding census

WATER SUPPLY: The Village of Petitcodiac gets its water supply from private wells which average in depth from 38 m to 46 m and have average pumping rates of 0.4 l/s. There is no demand on the area's water resource by local, commercial or industrial interests.

WATER QUALITY: The water quality is described by village officials as "reasonably hard" with high concentrations of iron. All the homes in the interval area use softners for their household supply. There may be a slight coloration to the water and staining of dish washers occurs. Occasionally there is a sulphide smell to tap water.

WASTE TREATMENT: A public sewage system was installed in the Village of Petitcodiac in 1966. A gravity flow system is used and a 2 hectare sewage stabilization pond is located between the Petitcodiac River and Renfrew Street, north of the village centre. Flow-through the treatment pond was measured in May, 1982 during a time of prolonged precipitation. At that time, the flow-through (charge loading) was 55.5 kg/hectare/day with an influent BOD loading 45 mg/litre. Care is taken by the municipality to maintain optimum conditions for the sewage treatment pond and the immediate ara. There is a separate storm sewer system along a few streets in the centre of the village. One life station is located in the area north of the Petitcodiac River.

A few homes are on the north extensions of Renfew Avenue and Post Road and two homes on Covey Avenue are serviced by private septic systems. Plans have been made to these areas into the system in the spring of 1985. The areas covered with a sandstone base, as is most of the core area of the Village of Petitcodiac, do not provide the best conditions for septic tanks. Municipal sewage treatment systems in areas of intensive development guard against potential pollution of groundwater resources.

See Table (3.11) for details of operation conditions at waste stabilization lagoon.

FIRE PROTECTION: The village's fire department secures water for three pumper trucks (total capacity approximately 14,000 litres) from a wet well one metre below the Petitcodiac River bed behind the fire station and also from a pond and the river itself. The pumping rate is approximately 6.5 l/s. The village has a secure water supply for fire protection purposes for both summer and winter.

FLOODING: Flooding occurs in the area west of Renfrew Avenue and east of Post Road. Flood water levels have topped the lagoon dykes and submerged the lagoon. No buildings have been directly flooded. There have been no problems with flooding in the last two years.

3.10 The Village of Port Elgin

LOCATION: The Village of Port Elgin, situated on the shores of Baie Verte in the southeastern portion of the Province, is located in two parishes, Westmorland and Botsford, in the County of Westmorland. Access to the village is by way of Route 15 from Shediac and Route 16 from Aulac. A relatively isolated community, Port Elgin is 80 km from Moncton and about 32 km from the Town of Sackville.

TOPOGRAPHY: Land lying north and south of the Gaspereau River, which flows through the village centre, slopes gently to the river, but generally speaking, Port Elgin is located on a very flat land. The village consists of 233 ha. of land, 29% of which is developed. Twenty One (21) ha. of low lying land within the municipal boundaries has problems of poor drainage. Another 21 ha. constitute swamp land and flood plain covers an estimated 7 ha.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Petitcodiac

TABLE (3.11)

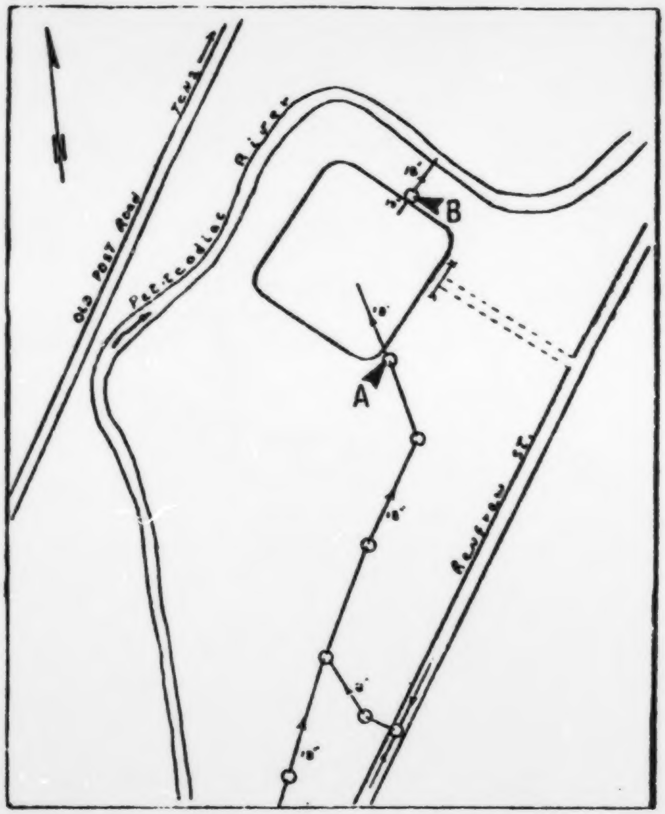
POPULATION 1,472

SURFACE DU BASSIN
POND AREA 2.0

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 55.5

MISE EN OPERATION
BEGINNING OF OPERATION 1966

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979		27		60		2.5		9.5
1980	93	35	107	60	7.7	2.4		
1981								
1982	45	11	56	10	3.7	2.4	23.0	7.9
*	68	17	78	26	5.5	2.4	24.0	7.9

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

PROFILE: Port Elgin, originally named Gaspereaux, was settled in 1836 and later renamed in honor of Lord Elgin, a Governor-General of Canada. The word "Port" was added in recognition of the significance of the village's shipping facilities. Ship building was the village's original major industry but fishing, lumbering and manufacturing contributed to Port Elgin's early economic fabric. Today, there is no industrial base nor any major industrial or commercial water useage. The village serves as an area service centre and was incorporated in 1922.

POPULATION: In the early twentieth century, Port Elgin displayed a steady growth rate but there has been no consistency in the population trend until the last twenty years. Since the mid-fifties, there has been an average yearly decline of 1.7%. The 1981 census population of 504 indicates a reverse trend of 2% (increase) over the 1976 census population of 492. There were 185 occupied dwellings in the village at the time of 1981 census count.

YEAR	CENSUS POPULATION	CHANGE
1971	550	
1976	492	-10% decrease
1981	504	2% increase

WATER SUPPLY: The Village of Port Elgin has two working wells which supply the community's water needs. These wells, together with an unused third well, are located in the Coburg Road wellfield approximately one half mile south of the village boundary on Route 16. The two operating wells have a combined capacity of 3.3 l/s and together 2.0 l/s supplying a demand which averages approximately 45,500 litres per day (estimated). Although chlorinators are installed, there is no supply water treatment. The water demand is not metered and there are no major water users of the municipal supply. Construction of a new pumphouse on Fort Street was completed in 1984.

One storage tank of 437,000 litre capacity, feeds a gravity distribution system with an inlet pressure of 3.2 kg/cm^2. There is no backup supply available. Future water supply will probably be secured from a third well drilled in the same area of present supply. Information related to wells, maximum capacity and type of aquifer is presented in Table (3.12).

TABLE (3.12) PRODUCTION WELLS-VILLAGE OF PORT ELGIN

	WELL #1	WELL#2	WELL#4
Well Location	Coburg Rd.	Coburg Rd.	Coburg Rd.
Well Depth (m)*	76	52	49
Well Diameter (cm)	20	20	20
Safe Yield (1/s)	1.5 1/s	2.3	1.5
Status	Standby (Abandoned)	Main Supply	Additional Supply

*Source: Donald M. Callan, P. Eng.

HYDROLOGICAL DISCUSSION: In 1977, W.H. Crandall and Associates Ltd. did a groundwater development study in the Village of Port Elgin. The following summarizes the consultants conclusions and includes extracts from the report of the hydrogeological study conducted at that time.

The Coburg wellfield showed aquifer properties of transmissivity and storativity over a relatively wide range of values. Values calculated at some distance from the pumping centres are considered representative for the aquifer; the values accepted are T-4525 igpd/ft and S-0.003. The limit of the cone of depression (r O) in T.W. 2 appears to be in the order of 360 m in a westerly direction.

Recharge is evident to each well after sufficient time has passed for the expanding cone of depression to intersect sufficient flow. In TW2, this took 30 minutes; in TWI it took 60 minutes and in TW4 it occurred after 300 minutes. Using a total pumping rate (wells 2 and 4) of 3.8 l/s, the net drawdown in TW2 is 5.7 m and TW4, 4.8 m. The maximum aquifer yield in the Coburg region was estimated to be about 30-35 l/s. This limit is imposed by estimates of the perenially available recharge from precipitation in that area.

The maximum yield per well is limited by maintaining drawdown above sea level. This limit is suggested in order to inhibit or minimize sea water encroachment to the aquifer system. The available safe drawdown in the region of the well field is therefore about 6.6 m. The two wells are hydraulically connected. In order to optimize water quality, prevent intrusion of salt water to the aquifer and maintain safe yields, the wells should be pumped at no greater rates than TWI, 1.5 l/s, TW2, 2.3 l/s, TW4, 1.5 l/s.

WATER QUALITY: The quality of Port Elgin's water supply is described by village officials as "good" north of the Gaspereau River and "salty" on the southside. This probably refers to the time when water was secured from private wells. Chemical analysis of the village's well supply indicate the limits of all parameters, with the exception of pH, are within the guidelines set by the Canadian Drinking Water Quality, 1978. Both operating wells supply water with pH 8.7-8.8. The village's third well was taken out of service in the spring of 1982 because of deteriorating quality, specifically brown coloration. Refer to Table (3.13) for results of chemical analysis of well water in Port Elgin.

Table (3.13)Chemical Analysis August, 1981 Village of Port Elgin

PARAMETER	WELL #2 COBURG ROAD	WELL #4 COBURG ROAD	TOWN HALL	MAXIMUM* ACCEPTABLE CONCENTRATION
Potassium mg/l	1.1	1.1	1.0	
Calcium mg/l	6.9	16.	7.6	200.
Flouride mg/l	L.1	L.1	L.1	1.5
Sulfate mg/l	9.7	8.9	10.	500.
Nitrate mg/l	.02	L.01	L.01	10.
Alkalinity mg/l	150.	144.	140.	30 to 500
Conductivity us/cm	380.	370.	380.	
pH ph units	**8.8	**8.7	**8.7	6.5 to 8.5
Turbidity NTU	2.5	3.0	1.4	5.0
Nitrite mg/l	L.01	L.01	L.01	1.0
Sodium mg/l	66.	55.	65.	270.
Iron mg/l	.05	L.05	L.05	0.3
Manganese mg/l	L.01	L.01	L.01	.05
Copper mg/l	L.01	L.01	.02	1.0
Lead mg/l	L.05	L.05	L.05	.05
Zinc mg/l	.02	.03	L.01	5.0
Aluminum mg/l	L.10	L.10	L.10	
Chloride mg/l	14.	13.	14.	250.
Silica mg/l	10.	10.	10.	
Magnesium mg/l	1.1	2.	1.4	150.
Hard mg/l	21.758	48.186	24.741	120.

**Indicates greater than acceptable limit

*Guidelines for Canadian Drinking Water Quality, 1978

WASTEWATER TREATMENT: A 2.8 ha. lagoon (oxidation pond) located between Fort Street and the Gaspereau River, provides secondary treatment for a design population of 750 (W.H. Crandall & Assoc. Ltd.). Seventy percent (80%) of the municipality has a separate storm drainage, which outlets to the Gaspereau River. See Table (3.14) for operating conditions at the treatment plant.

FIRE PROTECTION: Water for the fire fighting is secured from the municipal supply. The village has 42 hydrants. They also have two tankers (5,625 litre capacity each) and one combined pumper tanker (1,575 litre capacity).

3.11 The Village of Rexton

The Village of Rexton is located on the estuarine Richibucto River in the parish of Richibucto, Kent County. The village is one of several small coastal communities located along the main transportation route (Route 11) in Kent County. The municipality is divided by the Richibucto River and community activity is mainly concentrated on the north shore of the river close to the bridge. The land within the village is generally low lying and flat with extensive marsh area.

During the 19th century, ship building and timber exploration were the basis of Rexton's economy. This village at one time ranked as the second largest ship building centre in New Brunswick, second only to Saint John. The New Brunswick Department of Highways is the community's major employer today. The Village of Rexton was incorporated in 1966.

POPULATION: During the past decade, 1971-1981, the census population of the Village of Rexton increased. In 1981 there were 928 persons living in the municipality, an increase of 6% over the 1976 population of 872. There are 294 occupied dwellings in Rexton. Village officials believe the location of the newly constructed Mitel electronics plant in Buctouche will ensure the continued population growth of Rexton.

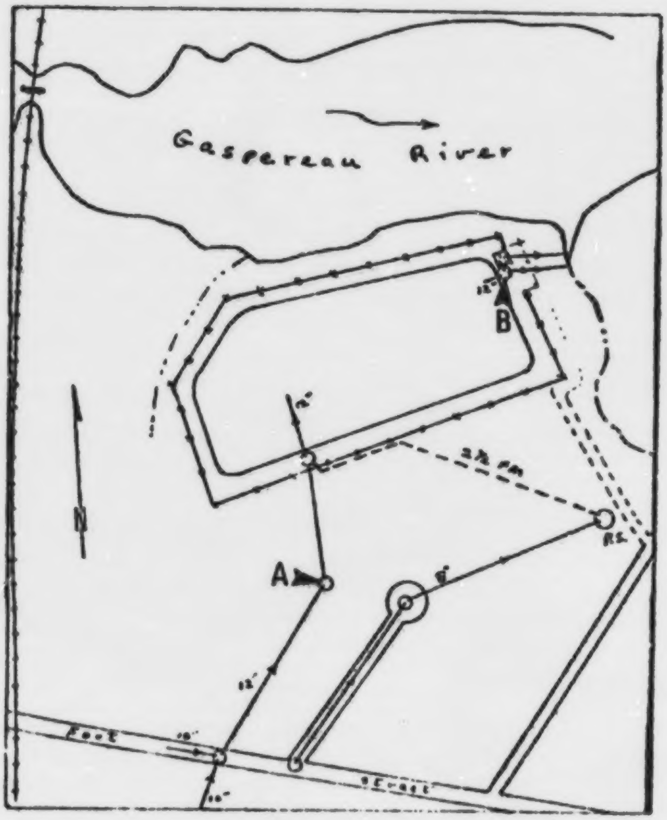
YEAR	CENSUS POPULATION
1971	755
1976	872
1981	928

WATER SUPPLY: The residents of the Village of Rexton secure their water from private wells. These wells vary in depth from 9.5 m to 18 m. Warren Ready Mix Ltd., is the village's only major water user. This water supply is secured from a 20 m deep private well.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Port Elgin

TABLE (3.14)



POPULATION 492

SURFACE DU BASSIN
POND AREA 2.8

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 15.7

MISE EN OPERATION
BEGINNING OF OPERATION 1976

INDUSTRIES MAJEURES
MAJOR INDUSTRIES

Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979		L10		49		3.2		7.0
1980		L10		34		3.3		
1981		L10		L11		3.2		4.7
1982	-	25	-	38	-	2.5	-	7.1
*	-	L11	-	36	-	3.0	-	7.0

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

WATER QUALITY: The water secured from wells located on that part of the village south of the Richibucto River is described by village officials as being "hard". Otherwise the water quality appears to be acceptable to the residents of the village.

WASTEWATER TREATMENT: A 4 hectare lagoon is located in the southeast sector of the village. The waste stabilization pond, designed for a population of 2,000, services the waste treatment needs of the community. Approximately 15 dwellings are excluded from the collection system. They are in the Normandie Court and "C" Street areas of the village. The effluent from the treatment plant, which is chlorinated during the months of April to September, outlets into Beatties Creek. Sixty percent (60%)of the sewage collection system has separate storm drainage. For a summary of the operating conditions at the lagoon, see Table (3.15).

FIRE PROTECTION: A 64 m well with 25 cm casing, pumps 11 l/s to provide the village's water for fire protection. The village also has two tanker trucks (6,750 litre capacity each). They are also equipped with two power take-off pumps; each with a capacity of 3.74 l/s.

3.12 The Village of Richibucto

The Village of Richibucto is situated near the mouth of the estuarine Richibucto River in the Parish of Richibucto, Kent County. The main access to the village is via Route 11. This highway cuts through the village as it follows the Richibucto River. The City of Moncton is 74 km to the south and Chatham is 64 km to the north.

The municipality encompasses about 1,295 ha. of land, of which 79 ha. has been developed residentially. A forested area (652 ha) lies to the west of the village centre.

The New Brunswick Department of Transportation maintains a public wharf in the village centre. This village is one of the oldest Acadien settlements in New Brunswick and the majority of the population in Richibucto is french speaking. The village of Richibucto was incorporated in 1966.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Rexton

TABLE (3.15)

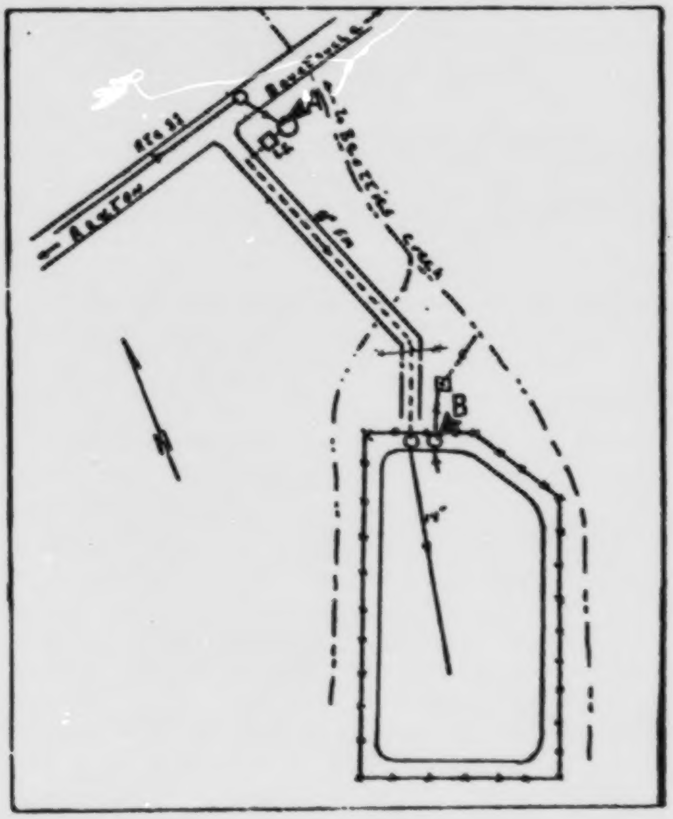
POPULATION 872

SURFACE DU BASSIN
POND AREA 4.0

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 16.4

MISE EN OPERATION
BEGINNING OF OPERATION 1976

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	145	L11	99	30	7.3	1.5	35	4.0
1980	114	L10	198	27	20.9	2.3		5.2
1981	135	L12	155	23	6.2	1.9	35.5	5.0
1982	150	15.0	158	14	9.3	1.5	37.0	7.4
*	150	10	95	24	7.3	2.2	39.0	6.0

* Valeurs médianes obtenues les dernières années.
Median values obtained over the past 3 years.

The community's main industries are United Maritime Fishermen, Atlantic Distillers Ltd. and Laurentide Chemicals Atlantic Division Ltd.

POPULATION: The census population of the Village of Richibucto declined 10% between the years 1976 and 1981. In 1981 the population was 1,722 and there were 535 occupied dwellings in the municipality.

YEAR	POPULATION
1966	1,668
1971	1,850
1976	1,909
1981	1,722

WATER SUPPLY: Private wells are the source of most of the Village of Richibucto's water supply. These wells have depths between 6.7 m and 46 m. A community well located off Renaud Court has been in use since 1968 and now supplies water to 40-50 dwellings in the village. These include 22 low rental housing units, 20 trailer lots south of Morgan's Lane and village arena. This well is approximately 30 m deep and cased to 21 m - 23 m. The main water line extends to service all of Renaud Court with a 15 cm diameter water line and smaller 5 cm diameter lines to the arena and trailer park.

WATER QUALITY: The quality of ground water in the Village of Richibucto is generally rated by the village officials as "poor". Residents, referring to taste and coloration, describe the water as "boggy". The concentration of iron and manganese in the water from the N.B.H.C. Community Well greatly exceeds the guidelines for Canadian Drinking Water Quality published by Health and Welfare Canada in 1978 (i.e. 0.3 mg/l for iron and 0.05 mg/l for manganese). Water softeners are used by the majority of residents because of the excessive hardness which exceeds the recommended 120 mg/l concentration. See Table (3.16) for the most recent chemical analysis of the village's water supply.

Excessive concentrations of manganese and iron in the ground water supply cause aesthetic problems such as colouration, taste, staining of wash and fixtures and scale build-up in pipes. The problem of water line corrosion and blockage in the water supply system has increased over the years. The high iron and manganese content in water from the well is oxidized when it comes in contact with air in the water system's hydropneumatic tank with the result that pipe corrosion and tuberculation have become problems for the village.

TABLE (3.16) CHEMICAL ANALYSIS, AUGUST, 1982

VILLAGE OF RICHIBUCTO

Parameter	Village Office	NBHC Community Well	Maximum Acceptable Limits*
Potassium(mg/l)	1.4	1.0	
Calcium(mg/l)	40.	43.	200.
Flouride(mg/l)	.11	L.10	1.5
Sulfate(mg/l)	23.	7.7	500.
Nitrate-Nitrite(mg/l)	.02	.02	10.
Alkalinity(mg/l)	89.	95.	30 to 500
Conductivity(us/cm)	520.	369.	-
pH (pH units)	6.81	7.14	6.5 to 8.5
Turbidity (NTU)	1.2	2.1	5.0
Nitrite (mg/l)	L.01	L.01	1.0
Sodium(mg/l)	32.	12.	270.
Iron(mg/l)	*10.	*.52	0.3
Manganese(mg/l)	*1.1	*.90	0.05
Copper(mg/l)	L.01	.62	1.0
Lead(mg/l)	L.05	L.05	0.05
Zinc(mg/l)	.20	.05	5.0
Aluminum(mg/l)	L.10	L.10	-
Chloride(mg/l)	70.	42.	250.
Silica(mg/l)	12.	18.	-
Magnesium(mg/l)	10.	4.2	150.
Hardness(EPM)	*141.05	*124.662	120.

*Guidelines for Canadian Drinking Water Quality, 1978

In 1983, consultants were retained by the village to suggest possible alternatives to the expensive practice of continual line cleaning or replacement. Following a review of the village's existing system, the firm of W.H. Crandall & Associates Ltd. made the recommendation that an industrial manganese greensand filter be used to remove dissolved iron and manganese. In the event that funding or financing were not immediately available to the village for installing and maintaining such a water treatment facility, an alternative method was recommended which requires the addition of a chemical (Calgon TG-10) to keep the iron and manganese element in dissolved state for a period of time so as to prevent the build-up of tubercles in pipes, etc. In the meanwhile, the consultants recommended that the village clean the lines to avoid blockages, reduce pumping costs and increase flow characteristics of the community supply.

WASTEWATER TREATMENT: The Village of Richibucto has a municipal wastewater treatment facility which services 98% of the community. Two adjacent lagoons which are located on the north side of the village west of Route 11. Storm and sewer drainage is separated. The lagoons discharge into Mooney's Creek. Refer to Table (3.17) for operating conditions at these plants.

FIRE PROTECTION: The community has an adequate water supply for fire protection purposes. A private well and an underground reservoir are located at the fire station. Also, the village has two tanker trucks, each with a capacity of 4,500 litres.

3.13 The Village of Riverside-Albert

LOCATION: The Village of Riverside-Albert is located in Hopewell Parish in Albert County. The village lies between Lumsden and Caledonia Mountains on the north and the Shepody River on the South. Access to the village is by way of Route 114. Riverside-Albert serves as a sub-regional service centre for the southwest corner of Albert County.

The Village of Riverside-Albert was incorporated in 1966 as the result of the amalgamation of the municipalities of Riverside and Albert. The community consequently has encompassed two major developed sectors separated by considerable open space. Both sectors have a grocery store and a post office. The greater number of businesses are located in the Albert sector.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Richibucto

TABLE (3.17)

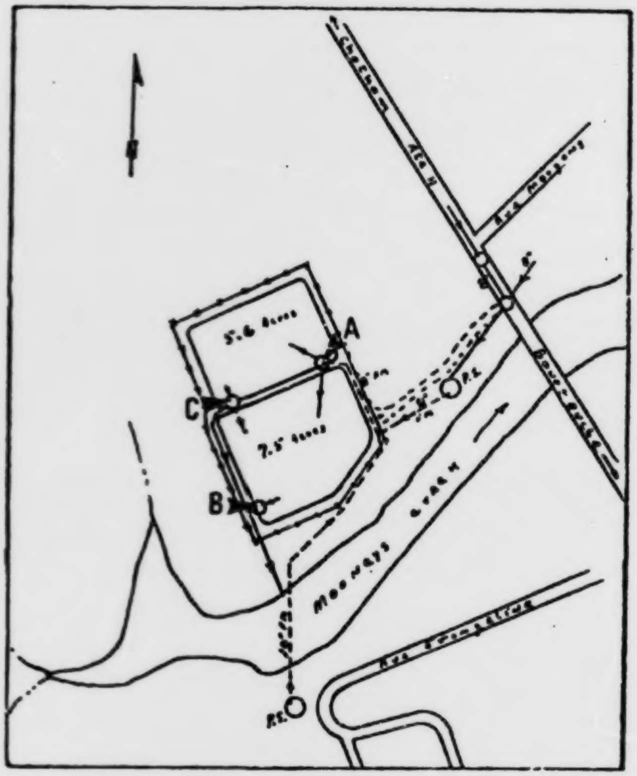
POPULATION 1726

SURFACE DU BASSIN
POND AREA 5.3

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 43.3

MISE EN OPERATION
BEGINNING OF OPERATION 1965,1978

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	240	28	350	140	12.3	4.0	58.0	16.0
1980	120	14	140	56	8.3	3.2		12.5
1981	65	L11	75	28	3.9	2.3	20.4	7.5
1982	99	22	105	25	4.7	2.5	27.0	10.7
*	105	15	118	31	5.7	2.6	29.5	10.8

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

POPULATION: During the last decade, the population of Riverside-Albert has not fluctuated significantly. In 1981, the village had 478 residents living in 151 dwellings.

YEAR	POPULATION
1971	509
1976	467
1981	478

WATER SUPPLY: The village of Riverside-Albert secures its water supply from a spring fed reservoir located north of Route 114. The ground level storage tank had an original capacity of approximately 0.27 million litres and has serviced the needs of the Albert sector of the village since 1925. This capacity was recently enlarged (capacity is unknown) when the Riverside sector of the village received municipal water services in the summer of 1982. Thirty to forty residences are not serviced by the municipal supply. Residences situated on Route 114 past Maple Street still secure water from private sources which includes drilled wells, dug wells and some spring fed supplies.

WATER QUALITY: The village's water supply is not treated. The water quality is described by the village's mayor as "excellent". Town officials suggest that a few homes (not identified) within the community have water of questionable quality and some residences suffer from a lack of sufficient quantity of low pressure during the dry months of the year. Officials indicate these residences will be serviced by the village supply as funds become available to allow for the expansion of the municipal supply and distribution system. See Table (3.18) for results of the most recent chemical anslysis conducted by the New Brunswick Department of the Environment.

WATER DISTRIBUTION: The pressure within the gravity fed distribution system averages 4.2-4.9 kg/cm^2 with a minimum pressure of 1.4-2.1 kg/cm^2 recorded in the Forest Dale Road Area. There are approximately 60 service connections. The present distribution system was expanded in 1982 to include the Riverside sector.

Village officials expect to secure the communities future water supply from spring fed sources in the area north of Stiles Road.

WASTEWATER TREATMENT: The Village of Riverside-Albert has no sewage treatment facilities. Septic tanks are used for the disposal of wastewater. There are isolated instances of improperly treated wastewater which result in the sewage flowing into open roadside ditches. Residences complain of persistent odor related to these situations.

TABLE 3.18 CHEMICAL ANALYSIS-JULY 1982
VILLAGE OF RIVERSIDE ALBERT

Chemical Test	Reservoir	Village Office	Maximum Acceptable Limits Concentration
Potassium (mg/l)	.21	.21	
Calcium (mg/l)	3.0	3.0	200
Flouride (mg/l)	L.10	L.10	1.5
Sulfate (mg/l)	5.4	3.4	500.
Nitrate (mg/l)	L.01	L.01	10.
Alkalinity (mg/l)	11.	11.	30 to 500
Conductivity	37.	375.	
pH (pH units)	6.4	6.3	6.5 to 8.5
Turbidity (NTU)	.19	.36	5.0
Nirtite (mg/l)	L.01	.02	1.0
Sodium (mg/l)	1.8	2.0	270.
Iron (mg/l)	L.05	L.05	0.3
Manganese (mg/l)	.01	.03	0.05
Copper (mg/l)	L.01	.33	1.0
Lead (mg/l)	L.05	L.05	0.05
Zinc (mg/l)	L.01	.03	5.0
Aluminum (mg/l)	L.10	L.10	
Chloride (mg/l)	L5	L5.	250.
Silica (mg/l)	5.1	5.1	
Magnesium (mg/l)	.76	.76	150.
Hardness (EPM)	10.62	10.62	120.

FIRE PROTECTION: The village has several surface water sources which insure the adequate supply of water for fire protection. Fourteen fire hydrants (not all functioning) are located within the village boundaries.

3.14 The Town of Riverview

The Town of Riverview is located in the Parish of Coverdale in Albert County. Situated on the south shore of the Petitcodiac River, access to the City of Moncton on the opposite shore is via Route 114. The town was incorporated in 1973.

POPULATION: In the year 1976, this town had a population of 14,177; in 1981 the census population was 14,907. There were a total of 4,464 occupied dwellings in the Town of Riverview.

WATER SUPPLY: The Town of Riverview secures its water from Turtle Creek (i.e. the City of Moncton). Approximately 98% of the community uses the municipal water. There are several residences mainly in Gunningsville area which still use private groundwater supply. These wells may also be used to supplement the town's supply.

An elevated 3.41 million litre standpipe located east of Gunningsville has the capacity to supply the 24 hour water demand of the town. The water consumption in this town of approximately 15,000 people is 3.41 million litres per day (Town Superintendent of Works). This represents a per capita consumption of 241 litres/day based on 95% use. (The City of Moncton metered water consumption demand of 305 million gallon per year for the Town of Riverview in 1981. This figure suggests that the per capita water demand in Riverview in 1981 was 268 litres/capita/day based on 95% use). There are approximately 7 breaks a year in the town's gravity fed distribution system. This trend holds true as there were 7 breaks in 1984. There are no major industrial or commercial water users in the Town of Riverview.

WATER QUALITY: The water supply which is secured from the City of Moncton's surface supply is good in respect to the Guidelines set for Canadian Drinking Water Standards, 1978. There are some aesthetic problems with water quality, however, especially during spring months of the year. Streaking of laundry (wash) is one such problem. For discussion of water quality, refer to the water quality analysis of the original supply source, Turtle Creek Reservoir in Moncton.

WASTEWATER TREATMENT: The Town of Riverview does not have a municipal sewage treatment facility. Sewer and storm drainage is separated. Riverview has 12 outfalls to the Petitcodiac River. The Town of Riverview together with the City of Moncton and the Town of Dieppe is now assessing the collection and treatment alternatives available to the community (Boyd H. Touchie Engineering Ltd., 1983).

FIRE PROTECTION: The town has 489 hydrants (pressure is unknown). The town also has one tanker, one pumper/tanker, and two pumpers with capacities ranging from 2,750 litres to 4500 litres.

3.15 The Town of Sackville

The Town of Sackville is located at the mouth of Tantramar River in the Parish of Sackville, Northumberland County. The town is 43 km south of the City of Moncton and 10 km from the Nova Scotia border.

Sackville is a university town which serves as a service and employment centre for the surrounding district. The development pattern is comprised of a downtown central business district, a university campus, an organized residential development in the original town and ribbon type residential development in the newly annexed areas. The town's major employers have been Enheat Inc. Fawcett Division and Enterprise Foundry Co. Ltd. The latter firm ceased operations in the winter of 1983. Sackville was incorporated in 1903.

GEOLOGY & TOPOGRAPHY: The land in Sackville slopes gently toward the river and generally is low and poorly drained.

The area is underlain by beds of grey and red siltstone, sandstone and conglomerate of Pennsylvanian age. These are the Pictou group rocks.

POPULATION: The population of the Town of Sackville has remained relatively stable while maintaining a slight growth trend since its incorporation as a town. The 1981 census population was 5,654. There are a total of 1957 occupied dwellings.

YEAR	POPULATION
1931	2,234
1941	2,489
1951	2,873
1961	3,038
1966	3,186
1971	3,180[1]
1976[2]	5,755 (3% increase from preceding year based on 1976 boundaries)
1981	5,654 (2% decrease from preceding year)

[1] 1971 population based on boundaries as of June 1976 is 5,595

[2] Boundary changes from preceding census

WATER SUPPLY: The Town's public water supply is secured from 3 working wells. Two of these are overflow wells flowing into two open reservoirs, located on Cedar Brook, west of the Trans Canada Highway and South of Walker Road. These reservoirs together contain approximately 162 million litres of water storage. The upper reservoir, with 68 million litres storage capacity, is able to accommodate the town's present water demand.

The well depth of the town wells is between 122m-152m, well diameters are 20 cm to 25 cm and the total pumping capacity is approximately 63 l/s. (Public Works Superintendent).

The average total water demand in the Town of Sackville is 4.5 million litres per day. The towns maximum demand rate is approximately 73 million litres per day. These rates are based on total water pumped during the year 1981.

The major user of the municipal water supply is the University of Mount Alison. This demand is now metered and the consumption rate is dependent on the school year. The University has installed some water conservation devices. The estimated maximum water demand by this institution is 218 million litres per year. (Public Works Superintendent). Enterprise Foundry Co. Ltd. used 59 million litres in 1981 in Fawcett Foundry used 27-32 million litres a year when operation was in full production. These demand rates are bsed on 1981 figures. See Table (3.19) for 1981 water demand.

TABLE (3.19) WATER DEMAND, 1981-TOWN OF SACKVILLE

Average total daily demand	4.5 million litres per day
Maximum total daily demand	7.27 million litres per day
Major users:	
Mt. A. University	0.60 million litres per day
Enterprise Foundry Co. Ltd.	0.16 million litres per day
Fawcett Foundary	0.08 million litres per day
Average domestic demand	3.66 million litres per day
Maximum domestic demand	6.43 million litres per day
Census 1981 population	5,654
Per Capita Average Daily demand (Domestic Use)	647 litres/capita/day

WATER DISTRIBUTION: The town's water distribution system is gravity fed with the location of the intake 6.1 m below the surface of the upper reservoir. The reservoirs are 76 m and 84 m above sea level. Static head is approximately 23 m. Water mains are 20 cm - 36 cm. Pressure is between 5.0 - 5.3 kg/cm^2. A low pressure area is located in the York St.-Raworth St. area. This problem has since been corrected. Some of the Town's mains had not been cleaned since 1903. Since 1980, water mains are flushed twice yearly.

WATER QUALITY: Analysis of the Town's public water supply shows water quality to be excellent except for the excessive concentration of manganese and iron. The content of both of these minerals exceeds the recommended acceptable limits of 0.05 mg/l for iron and 0.3 mg/l for manganese suggested by the Canadian Drinking Water Quality Guidelines, 1978. The well water is probably partly aerated in the reservoir before it reaches the consumer. This helps reduce the mineral content of water supplied to the user. Neither of these minerals, manganese or iron represents a health hazard to the community users and are mainly of aesthetic considerations.

Since the town reservoirs are open to the elements, there is a problem with silting and runoff contamination during periods of heavy rainfall. At such times, taste and water colour can be affected. This was particularly a bad problem in 1978 and 1979. The town had dredged the reservoir in 1984 and therefore, this problem has been corrected.

The town's water supply is chlorinated. The design flow of this treatment system is between 4.5 million litres and 9.1 million litres per day. Results of an analysis of the town's water supply done during the summer of 1982 by Environment New Brunswick is presented in Table (3.20). In the spring of 1983, a new flouride plant was installed.

WASTEWATER TREATMENT: Sackville has had a sewage treatment system since 1972. Waste water is treated in a double celled lagoon located in the south east sector of the town, east of Crescent St. and South of Route 6. This pond area is 8.0 hectares and these lagoons have a loading capacity of 51.1 hectare/day. Tantramar River is the receiving stream.

In 1979, another waste stabilization pond was added to the system to serve the Middle Sackville area. This lagoon is located east of Route 940 and south of Harper Road in the north central sector of the municipality. Morise Creek is the receiving stream. This pond area is 3.6 hectares and services a population of approximately 500. See Tables (3.21) and (3.22) for operation conditions at these two treatment plants.

TABLE (3.20) CHEMICAL ANALYSIS-July, 1982-SACKVILLE WATER SUPPLY

Parameters	Reservoir Intake	Well #3	Well #5	Well #7	Maximum* Acceptable Concentration
Potassium (mg/l)	.79	.81	.8	.8	
Calcium (mg/l)	11.	15.	12.	15.	200.
Flouride (mg/l)	.10	.10	.12	L.10	1.5
Sulfate (mg/l)	13.	17.	17.	17.	500.
Nitrate (mg/l)	L.01	L.01	L.01	L.01	10.
Alkalinity(mg/l)	28.	33.	34.	35.	30 to 500
pH (pH units)	7.2	6.9	7.0	7.1	6.5 to 8.5
Turbidity (NTU)	.38	3.0	2.3	2.9	5.0
Nitrite (mg/l)	L.01	L.01	L.01	L.01	1.0
Sodium (mg/l)	5.2	5.9	4.6	6.6	270.
Iron (mg/l)	*.45	*1.0	*1.3	*1.0	0.3
Manganese (mg/l)	*.59	*1.20	*1.50	*1.2	0.05
Copper (mg/l)	L.01	L.01	L.01	L.01	1.0
Lead (mg/l)	L.05	L.05	L.05	L.05	0.05
Zinc (mg/l)	.03	.04	.03	.11	5.0
Aluminum (mg/l)	L.10	L.10	L.10	L.10	
Cnloride (mg/l)	6.2	7.9	6.6	14.	250.
Silica (mg/l)	17.	19.	19.	18.	
Magnesium (mg/l)	2.4	2.3	3.2	2.2	150.
Hardness (mg/l)	37.348	46.924	43.138	46.512	120.
Conductivity (us/cm)	300	400	490	180	

*Guidelines for Canadian Drinking Water Quality, 1979.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Sackville #1

TABLE (3.21)

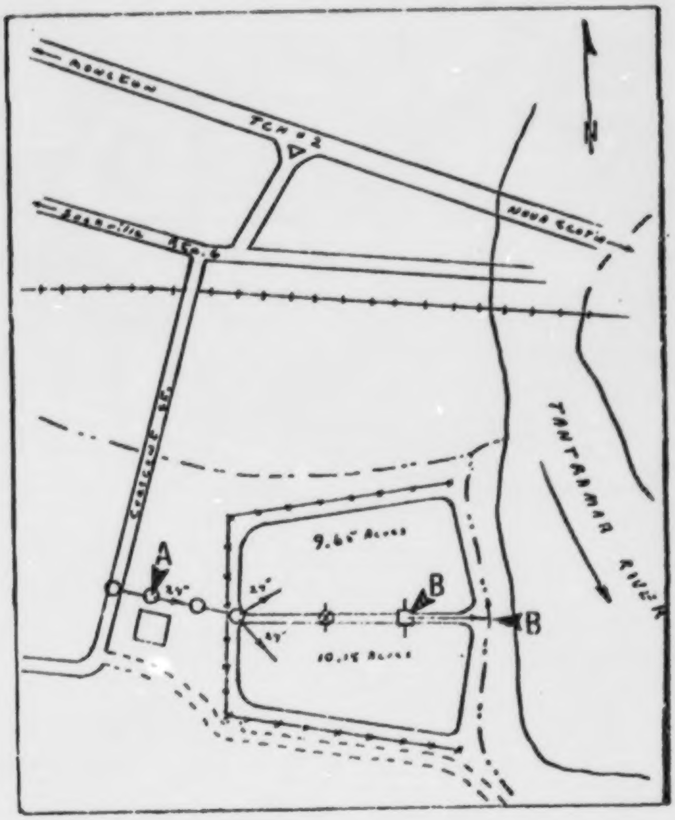
POPULATION 5,755

SURFACE DU BASSIN
POND AREA 8.0

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 51.1

MISE EN OPERATION
BEGINNING OF OPERATION 1972

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATX	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	103	19	96	54	4.3	2.6	20.5	9.9
1980	43	14	59	24	3.7	2.9		
1981		126		88		3.7		13.9
1982	59	32	68	38	3.7	2.8	16.0	9.1
*	59	21	68	38	3.7	2.8	16.0	9.7

* Valeurs médianes obtenues les 3 dernieres annees.
Median values obtained over the past 3 years.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Sackville #2

TABLE (3.22)

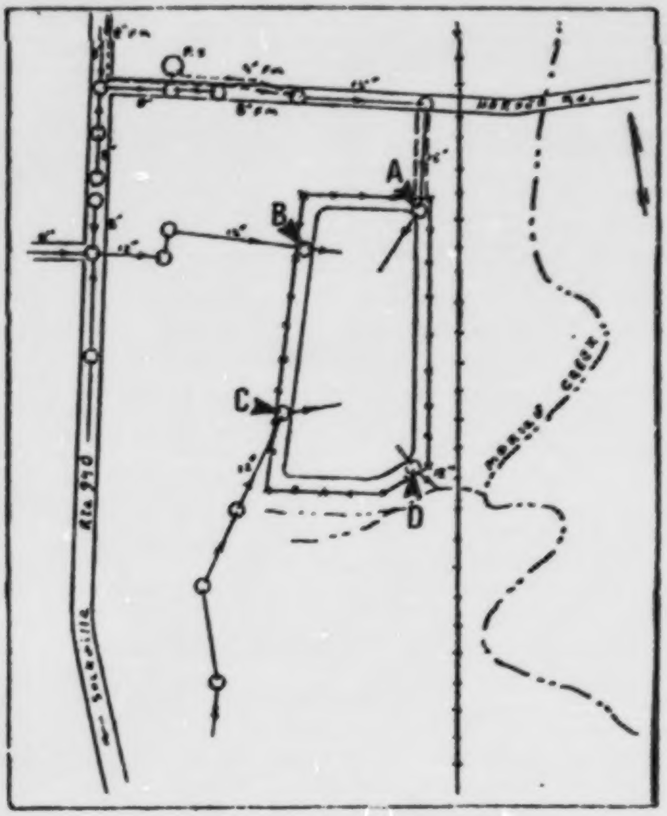
POPULATION 5,755

SURFACE DU BASSIN
POND AREA 3.6

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY ________

MISE EN OPERATION
BEGINNING OF OPERATION 1979

INDUSTRIES MAJEURES
MAJOR INDUSTRIES ________



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	220	L10	145	35	7.0	0.4	36.0	2.7
1980								
1981	175		445		9.2		58.0	
1982	123	18	134	37	4.9	2.1	33.5	4.6
*	125	18	162	37	5.0	1.7	36.0	5.2

* Valeurs médianes obtenues les 3 dernieres années.
Median values obtained over the past 3 years.

Storm and sanitary drainage is combined through 80% of the municipality. Approximately 400-500 dwellings are not connected to the municipal sewer system.

FIRE PROTECTION: Fire protection for the town is the town's water supply and approximately 212 hydrants are located throughout the town. Recently, the town's water mains were cleaned. This resulted in a flow increase from 33 l/s before cleaning to 114 l/s after cleaning.

3.16 The Village of St. Antoine

The Village of St. Antoine is located in the Parish of St. Mary in Kent County about 32 km north of the City of Moncton. Route 525 bisects the village proper and is the village's main throughfare. The village is mostly a residential community with the major settlement area located in the village centre near the church. The rest of the village is wooded with some open fields. The municipality covers an area of approximately 31 km^2.

Two food processing enterprises are the village's major employers. The Village was incorporated in 1966.

TOPOGRAPHY GEOLOGY: St. Antoine is located at 65°45' latitude and 46°22' longitude. Elevations within the village range from between 38 m to 60 m and the topography can be described as gently rolling. Alternating sandstone and shale beds underlie the village.

POPULATION: The census population of the Village of St. Antoine in 1981 was 1,217, a 15% increase over the 1976 census count of 1,062. However, there has not been a significant growth trend during the past two decades since the expansion of municipal boundaries in 1972 and again in 1977 account for increases in the population count.

In 1981, the Village of St. Antoine reduced the limits of the municipal boundaries and the village's municipal plan is being amended. Village officials are optimistic that growth will continue as a consequence of the village's proximity to the City of Moncton. St. Antoine has 402 occupied dwellings.

YEAR	CENSUS POPULATION
1961	718*
1971	756
1976	1062
1981	1217 (15% increase)

*Report on Water Systems and Extensions for the Village of St. Antoine (1972).

WATER SUPPLY: The village of St. Antoine secures water from private wells. The wells are generally shallow with the average depth between 21 m to 27 m. The Village has three wells, two of which are new. The old village well is 26.5 m deep.

WATER QUALITY: Village officials describe the quality of the water that is now secured from private wells as being "poor" and objection is made to the smell and colour. Water softners must be used by consumers because of high levels of maganese and iron. In 1980, approximately one dozen private wells in the area between Lauza Avenue and Rue Edouard became polluted as a result of a petroleum spill in that area. Contaminated wells were less than 30 m in depth. Ten to twelve new wells have since been drilled to about 76 m depths with 58 and 73 metres of casing.

Leakage of underground storage tanks at an Irving Station at approximately the same location, has been the reported cause of petroleum contamination of adjacent wells for the past 20 years or so. The offending storage tanks have been replaced.

HYDROGEOLOGICAL STUDY: In 1977, consultants were engaged by the Village of St. Antoine to investigate possible sources of future groundwater supply. Tests were performed to determine the yield and quality of three ground water sources within the municipality. These included an existing well on Gerard Street and two new wells on Marquis Avenue and at the corner of Canada and Donald Streets. The well off Gerard Street is deep, over 152 m and was drilled over 20 years ago. The new well #1 off Marquis Avenue is 69 m deep and pumps between 3.8 - 4.4 l/s. The second new well of Donald Avenue is 53 m deep and is able to pump 6.3 l/s. See Table (3.23) for well information. See Figure (3.5) for site location.

As a result of this study, the consultants suggested that the existing well on Gerard Street, which is capable of providing a flow of 3.2 l/s, together with new well #1 should be connected to the proposed village system. This combination of supply would reduce the high manganese content of well #1. Both wells should be lined with casing in view of the fact that shale zones in the area are unstable. The use of the new well #2 on Donald Avenue would necessitate either installing treatment facilities to reduce high iron and manganese contents or drilling to secure quality water at greater depths and casing off upper 37 m of the well. (Atlantic Groundwater and Geophysics Ltd., 1977).

TABLE (3.23) WELL INFORMATION-VILLAGE OF ST. ANTOINE

	Existing Well [1] (Gerard St.)	New Well 1[2] (Marquis St.)	New Well 2[3] (Roland St.)
Well Depth	133 m.	69 m.	53 m.
Well (Casing) Diameter	15 cm.	20 cm.	20 cm.
Static Water Level	-	12 m.	3.2 m.
Pump Setting	-	48 m.	48 m.
Pumping Rate	3.2 l/s	3.8 l/s	6.3 l/s
Specific Capacity	-	2 u.s.p.p.m./ ft. drawdown	5.3 u.s.g.p.m./ ft. drawdown
Transmissivity	-	1500 u.s.g.p.d./ ft.	4800 u.s.g.p.d./ ft.

SOURCE: ATLANTIC GROUNDWATER AND GEOPHYSICS LTD., 1977

1. Water from this well is soft with low iron and manganese content. Judged good in all respects for a municipal supply.

2. Well water is of good chemical quality; medium hardness because of higher calcium; manganese content may cause slight staining of fixtures and white linens.

3. Well water is of acceptable quality but tests show excessive iron and manganese content which will probably cause problems with odor, taste and staining.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
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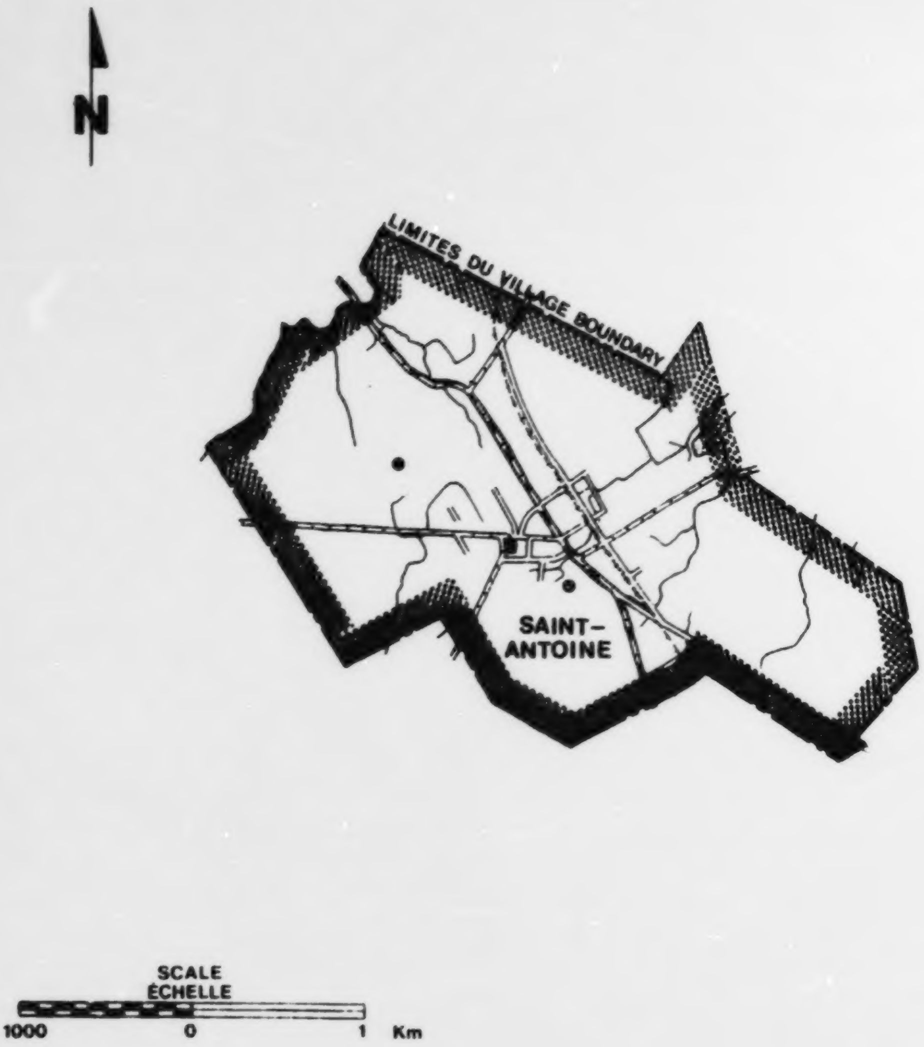
N
LIMITES DU VILLAGE BOUNDARY
SAINT-ANTOINE
SCALE
ÉCHELLE
Metres 1000 0 1 Km

LEGEND
LÉGENDE

- ■ **EXITING WELL**
  PUITS ACTUEL
- ● **NEW WELL**
  NOUVEAU PUITS

MONCTON PLANNING REGION
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ETUDE DES RESSOURCES EN EAU

LOCATION OF WELLS
SAINT-ANTOINE
REPLACEMENT DES PUITS

FIG.3.5

WASTEWATER TREATMENT: The Municipality of St. Antoine is serviced by three lagoons with a combined surface area of 4.7 ha. A 1.2 ha. lagoon is located in the northwest corner of the village north of Rue Principal (Route 525). Outflow is to the Little Buctouche River. Two adjacent waste stabilization ponds, one with a surface area of 2 ha., the other 1.5 ha., are located north of Chemin Renauds and near the village boundary. Smelt Brook is the receiving watercourse. (See Tables (3.24), (3.25) and (3.26) for operation conditions at the waste treatment facilities.

The village's sewer collection system was installed in 1962. Today the municipality has a collection system consisting of 9296 m of sanitary drainage and 1661 m of storm drainage. Storm and sanitary drainage are combined mainly in the village's core area. Areas of new (recent) development have separated drainage. The extension of Avenue de L'Eglise in the west of the village has open ditches to accommodate surface drainage.

Two food preparation enterprises in the Village, Claud Fricot Acadian Ltd. and Claude Poutines Rapees Ltd. now have a private holding tank for process effluent in order to prevent overloading of the public treatment system.

FIRE PROTECTION: A 0.20 million litre capacity reservoir at the site of the old fire station secures the village's fire fighting needs. The village owns two pumper and one tanker truck which together hold 13,600 litres. A new 0.22 million litre capacity reservoir has recently been built to supplement the needs of waster supply necessary for fire protection.

3.17 The Village of Saint Joseph

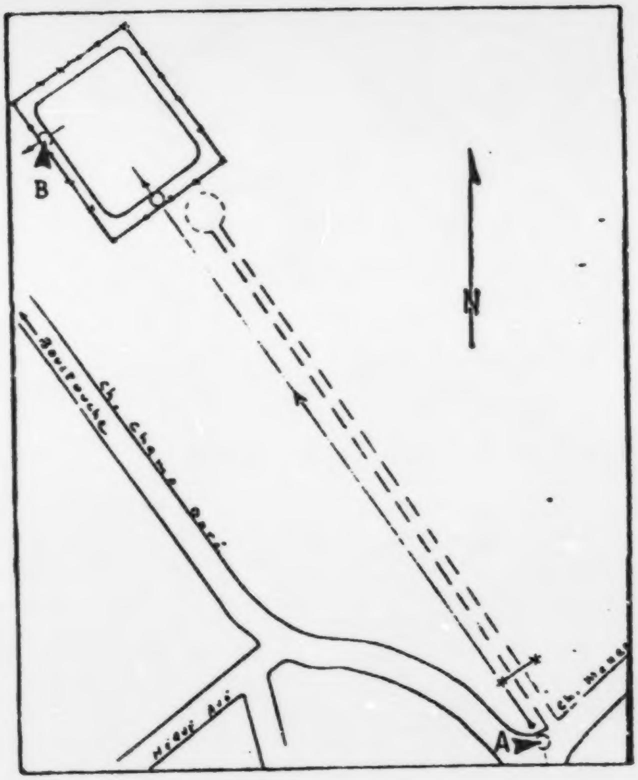
The Village of Saint Joseph is located on the west bank of the lower Memramcook River in Dorchester Parish, Westmorland County. It is approximately 29 km southeast of Moncton. Saint Joseph is mainly a ribbon type development along the Main Street which runs parallel to the Memramcook River. LeBlanc Creek bisects the municipality as it flows easterly into Memramcook River.

The centre of the village is approximately 0.6 km from Route 6 and approximately 5 km from the Trans Canada Highway. The village serves as a minor service centre for the surrounding unincorporated areas and a residential dormitory community for the City of Moncton. There is no major industrial activity in Saint Joseph. For over 100 years the Institute de Memramcook has been the focus of the village's socio-economic life and its largest local employer. The tourist potential in this valley remains untapped. The Village of Saint Joseph was incorporated in 1966.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE St-Antoine #1
MUNICIPALITY

TABLE (3.24)



POPULATION 236

SURFACE DU BASSIN
POND AREA 1.2

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 23.1

MISE EN OPERATION
BEGINNING OF OPERATION 1963

INDUSTRIES MAJEURES
MAJOR INDUSTRIES

Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

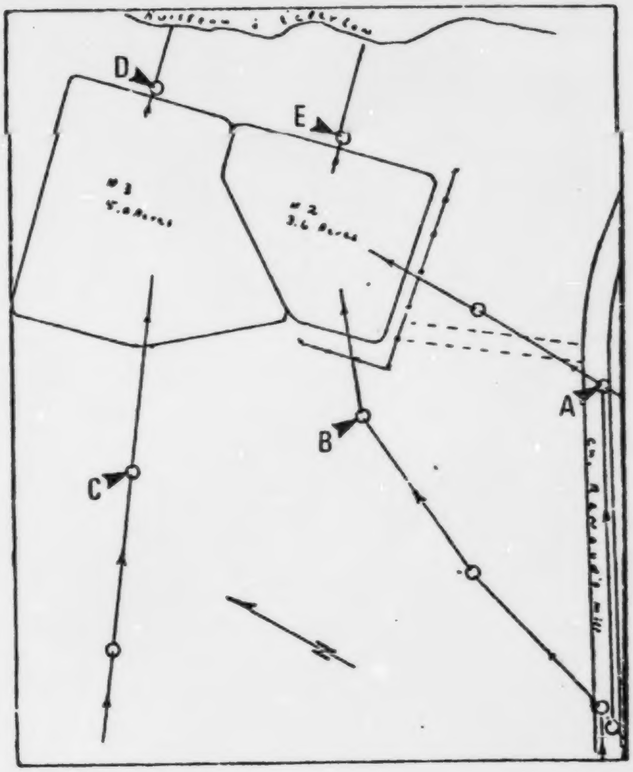
	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979		L10		L10		1.4		1.8
1980		L10		19		1.7		4.3
1981		L10		35		1.2		5.2
1982	59	13	56	L10	2.2	0.7	19.0	4.2
*	59	11	56	L15	2.2	1.2	19.0	4.9

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE St-Antoine #2
MUNICIPALITY

TABLE (3.25)



POPULATION 110

SURFACE DU BASSIN
POND AREA 1.5

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 89.8

MISE EN OPERATION
BEGINNING OF OPERATION 1973

INDUSTRIES MAJEURES
MAJOR INDUSTRIES Claude Poutine

Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979		L10		L10		1.6		2.0
1980	285	28	330	93	11.2	2.6		
1981		13		31		1.8		9.7
1982	130	25	238	26	6.0	2.2	41.0	11.0
*	150	21	260	33	7.0	1.9	64.5	9.5

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY St-Antoine #3

TABLE (3.26)

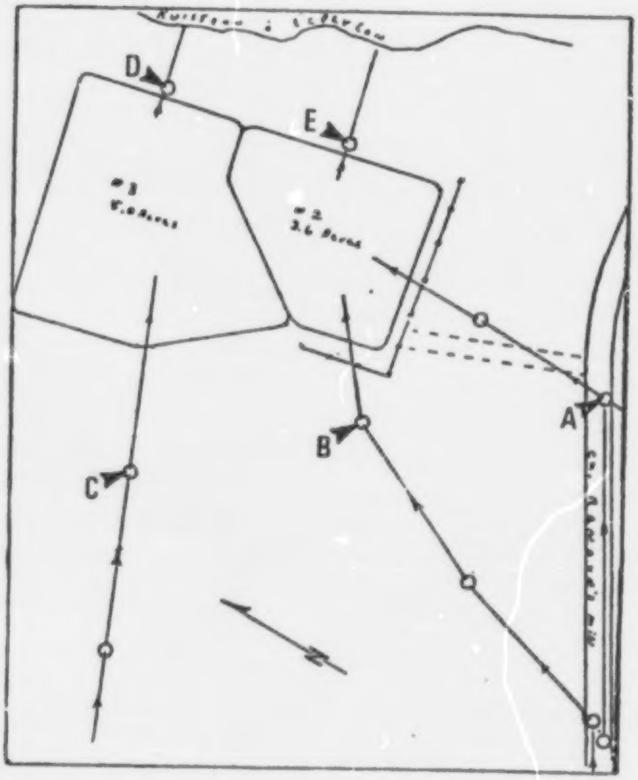
POPULATION 416

SURFACE DU BASSIN
POND AREA 2.0

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 13.3

MISE EN OPERATION
BEGINNING OF OPERATION 1975

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979								
1980		L10		14		2.5		5.4
1981		L13		23		1.6		4.9
1982	-	26	-	12	-	1.4	-	3.6
*	-	10	-	18	-	1.8	-	4.6

* Valeurs médianes obtenues les 3 dernières années.
Median values obtained over the past 3 years.

TOPOGRAPHY: The general topography within the village boundaries is gentle sloping in the direction of the Memramcook River. The marshes near the river have an approximate elevation of 8 m while the elevation in the vicinity of the Institute Reservoir on Michel Road is approximately 55 m. The major portion of the village lies between the 15 and 30 metre contour levels. Most of the western part of the village is wooded.

POPULATION: The 1981 census population of Saint Joseph was 630, a 15% decrease over the 1976 count of 741. The Village of Saint Joseph has not shown a steady population trend since the year of its incorporation in 1966. There were 196 occupied dwellings in Saint Joseph in 1981.

YEAR	CENSUS POPULATION
1966	751
1971	687 (-8.5% change)
1976	741 (7.9% change)
1981	630 (-15% change)

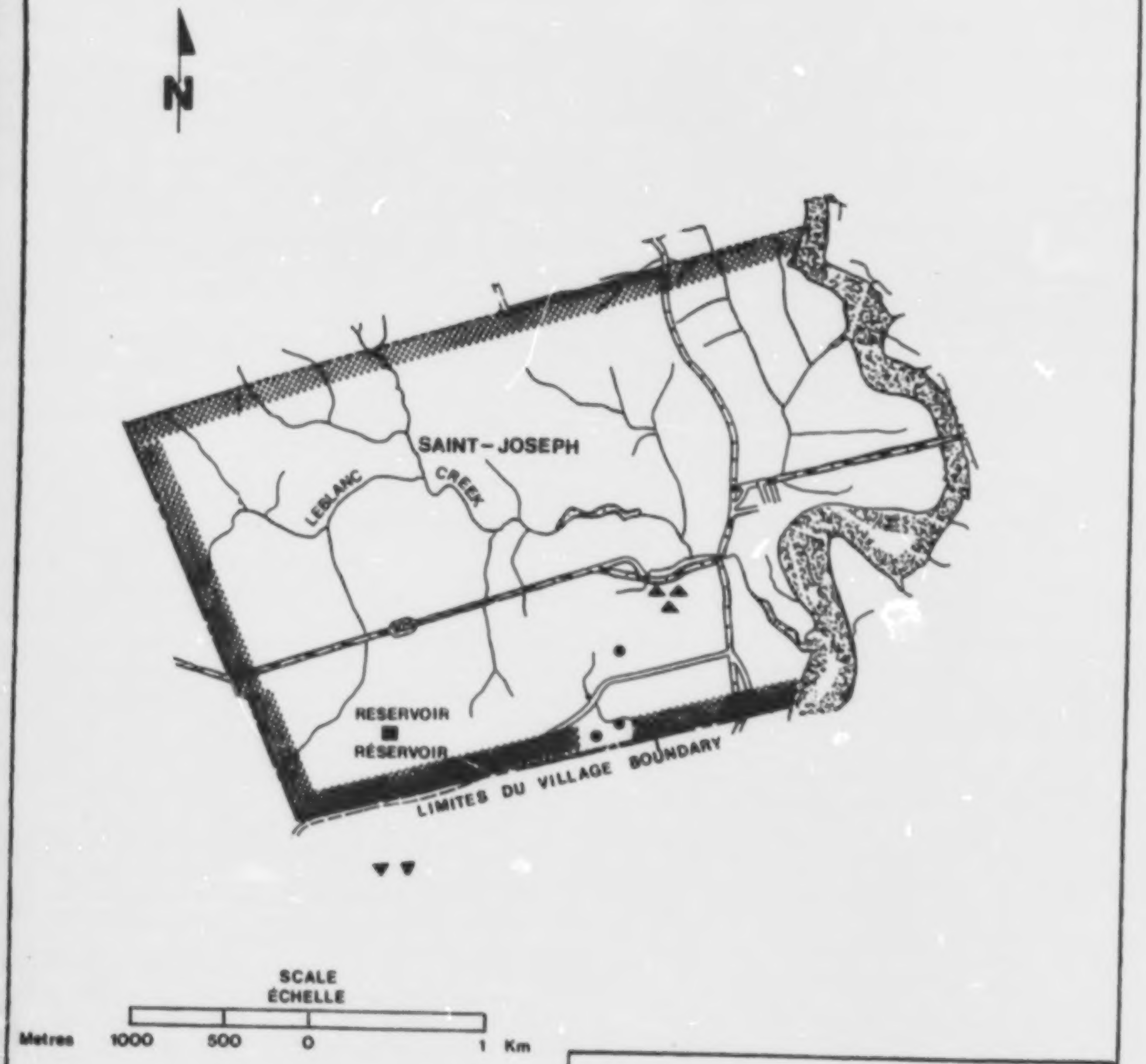
WATER SUPPLY: The Village of Saint Joseph secures water from 5 wells and 3 springs, Figure (3.6) and Table (3.27). The ground level 2.7 million litre storage tank, originally part of the Memramcook Institute water system, is supplied by springs located south of Michel Road and two recently drilled wells which are located on the southwestern outskirts of the village. Three small wells which formerly supplied the Convent, are located mid-way between Michel and Presden Haut Roads and west of Main Street contribute to the water supply as well. The wells are less than 18 m in depth and do not pump simultaneously.

The village's water demand averages 0.27 million litres per day (estimated) with a maximum water demand of about 0.36 million litres per day (estimated). Residential demand accounts for 83% of the water used while institutional demand (Memramcook Institute) is 15% of the total water flow. Memramcook Institute uses approximately 27.3 million litres a year. Commercial demand is approximately 2% of total water flow. Using these figures and considering the 1981 census population count, the average daily water demand (residential) for the village of Saint Joseph is 359 litres per capita per day. The maximum daily water demand, based on the same calculation is 470 litres per capita per day.

A gravity distribution system feeds 40 cm water mains and distribution pressure is between 4.6 to 4.9 kg/cm^2. All dwellings within the municipality are serviced. There are 157 service connections and water is metered at the source.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSOURCES EN EAU


N
SAINT-JOSEPH
LEBLANC CREEK
RESERVOIR
RÉSERVOIR
LIMITES DU VILLAGE BOUNDARY
SCALE
ÉCHELLE
Metres 1000 500 0 1 Km

LEGEND
LÉGENDE

- ▲ WELLS
  PUITS
- ▼ NEW WELLS
  NOUVEAU PUITS
- ● SPRING
  SOURCE

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

WATER SOURCES
SAINT JOSEPH
SOURCES D'EAU

FIG 3.8

TABLE (3.27) WELL INFORMATION

VILLAGE OF SAINT JOSEPH

1.	Well A:	Depth 12 m, diameter 15 cm-20 cm, yield 2 l/s; owned by the local parish and leased to the Village of Saint Joseph. The municipality maintains the well site; this well feeds main system reservoir (4 m x 2.4 m x 2.4 m)
2.	Well B:	Yield is 0.8 l/s
3.	Well C:	Yield is 1.1 l/s
		Wells B & C supply water to homes on Pre d'en Haut Street and feed into reservoir.
4.	Institute Pump House Well:	This well is connected to three separate spring sources, one of which has been disconnected because of water quality problems. This source is a good supply but the pump house well is generally susceptible to occasional bacterial contamination caused by surface water seepage.
5.	Cormier Pump House:	Actually a spring captured in a well well-reservoir (approximately 2.4 m x 2.4 m x 1.8 m with a 6.2 m2 surface area). The pump capacity is 1.5 l/s; maximum measured yield is 1.1 l/s. At times this yield is reduced either as a result of leakage or because of equalization of the natural water level head.

WATER QUALITY: Two of the village's five wells are equipped with sand filters and the water is chlorinated. The water from the three springs is chlorinated also. The treatment system is designed for a flow of 10 litres per second.

High levels of manganese are found in well "C" (.29 mg/l), Institute pump house (.27 mg/l), treatment plant well #1 (1.3 mg/l) and treatment plant well #2 (1.5 mg/l). The objective concentration of manganese set by the Guidelines for Drinking Water Quality in New Brunswick is 0.05 mg/l.

The iron concentration in water tested from the Institute Pump House was .49 mg/l and in the treatment plant well #2, .98 mg/l. These values exceed the 0.3 mg/l objective concentration based on the Guidelines for Drinking Water Quality. The occurrence of excessive mineral concentrations may cause aesthetic problems such as staining and scale build-up. Table (3.28) gives the results of water chemistry analysis of all water sources which contribute to Saint Joseph's municipal water supply and was done during the summer of 1982 by the New Brunswick Department of the Environment.

HYDROGEOLOGY: The springs scattered at the southern outskirts of the village are captured natural springs out of the grey sandstone of Pennsylvanian age which underly this area of the village. Grey sandstone is fractured to an uncertain depth and saturated with water, forming a local shallow sandstone aquifer system. The springs are supplied with groundwater from this aquifer. Located in the lower half of the sloping hillside, they intersect natural groundwater discharge areas.

During a drought period, usually in late summer and early fall, there is no recharge from precipitation and the flow toward the springs is sharply reduced because the shallow sandstone aquifer system is recharged directly by precipitation. Consequently, the village has in the past experienced a water supply shortage (Fisheries and Environment, 1974). Treatment plant wells #1 and #2 are now used during the dry season.

WASTEWATER TREATMENT: A 3.0 hectare lagoon receives the waste from the sanitary sewer system which serves the entire village. Except for a small area in Saint Thomas and Central Streets, surface drainage follows open ditches and some areas in the village has 147 service connections to residential dwellings and 10 connections to institutional and commercial buildings. The lagoon has an average flow through of .27 million litres per day. The maximum flow through is 0.36 million litres per day. The design leading capacity is 24.4 hg/hectare/day. The lagoon discharges into the Memramcook River. See Table (3.29) for information on operating conditions of the waste stabilization pond in Saint Joseph.

TABLE (3.28) CHEMICAL ANALYSIS-AUGUST,1982 - VILLAGE OF SAINT JOSEPH

PARAMETER	WELL "A"	WELL "B"	WELL "C"	INSTITUTE PUMP HOUSE	TREATMENT PLANT WELL #1	TREATMENT PLANT WELL #2	CORMIER PUMP HOUSE	BOURGEOIS PUMP HOUSE	MAXIMUM** ACCEPTABLE CONCENTRATION
Potassium (mg/1)	.89	.66	1.2	1.2	.72	.82	3.9	1.2	-
Calcium (mg/1)	5.8	11.	31.	15.	25.	29.	33.	11.	200.
Flouride (mg/1)	L.1	L.1	L.1	L.1	L.1	L.1	L.1	L.1	1.5
Sulfate (mg/1)	8.0	9.8	11.	13.	18.	13.	15.	15.	500.
Nitrate (mg/1)	L.01	L.01	L.01	.37	L.01	L.01	.7	.23	10.
Alkalinity (mg/1)	13.	19.	103.	37.	70.	81.	86.	21.	30 to 500
pH (pH units)	6.1	6.0	7.4	6.5	7.0	7.0	7.0	6.4	6.5 to 8.5
Turbidity (NTU)	3.4	.80	.68	.82	.59	1.5	.36	.28	5.0
Nitrite (mg/1)	L.01	L.01	L.01	.108	L.01	L.01	L.01	L.01	1.0
Sodium (mg/1)	3.1	2.7	12.	3.7	5.7	10.	11.	3.4	270.
Iron (mg/1)	.14	.18	.27	*.49	.19	*.98	L.05	L.05	0.3
Manganese (mg/1)	L.01	.03	*.28	*.27	*1.3	*1.5	L.01	L.01	0.05
Copper (mg/1)	L.01	L.01	L.01	.01	L.01	L.01	L.01	.01	1.0
Lead (mg/1)	L.05	L.05	L.05	L.05	L.05	L.05	L.05	L.05	0.05
Zinc (mg/1)	L.01	L.01	L.01	L.01	.11	.04	.01	.04	5.0
Aluminum (mg/1)	L.10	L.10	L.10	L.10	L.10	L.10	L.10	L.10	-
Chloride (mg/1)	L5.	L5.	L5.	L5.	8.2	16.	17.	6.8	250.
Silica (mg/1)	7.3	7.1	7.4	6.5	11.	11.	8.5	9.1	-
Magnesium (mg/1)	.92	1.3	2.4	1.8	4.3	3.6	3.9	1.9	150.
Hardness (mg/1)	18.27	32.819	87.288	44.866	80.128	87.234	98.457	35.289	120.

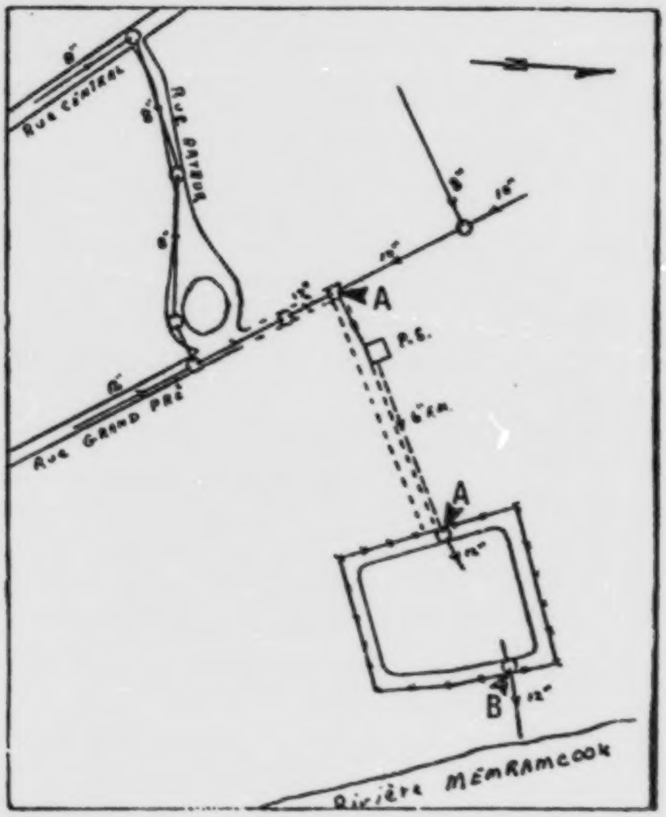
* Exceeds Guidelines for Canadian Drinking Water Quality, 1978.

** Guidelines for Canadian Drinking Water Quality, 1978.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY St-Joseph

TABLE (3.29)



POPULATION 741

SURFACE DU BASSIN
POND AREA 3.0

CHARGE Kg/HECTARE/JOUR
LOADING Kg/HECTARE/DAY 24.4

MISE EN OPERATION
BEGINNING OF OPERATION 1978

INDUSTRIES MAJEURES
MAJOR INDUSTRIES

Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	97	L10	180	35	17.7	1.0	22.0	5.4
1980	42	L13	62	25	4.7	2.7		9.2
1981		L10		30		1.9		3.7
1982	69	13	76	28	4.3	2.9	25.0	7.1
*	69	L10	76	28	4.7	2.2	25.0	7.1

* Valeurs médianes obtenues les 3 dernières annees.
Median values obtained over the past 3 years.

FIRE PROTECTION: The Village has 53 fire hydrants. In addition, the village has 1 pumper (5400) litre capacity) and 2 tankers (6750 and 8100 litre capacity). The municipal water supply is used for fire protection.

FLOODING: Fifteen percent (15%) or 120 ha. of the land within the village is floodplain. Flooding may occur in this low lying area at a time of high tides or as a result of rapid runoff from the uplands during periods of snowmelt or heavy rainfall. However, the floodplain area is mainly used for farming and very little urban development has occurred on this land.

3.18 The Village of Saint-Louis-De-Kent

Saint-Louis-de-Kent is located on the lower reach of the Kouchibouquasis River in the Parish of St. Louis, Kent County. The village is the only municipality located within the Kouchibouquac Area. Route 11 is the major access highway and this route bisects the village running northwest to Chatham and southeast along the coast of Northumberland Strait. The village was incorporated in 1966.

The municipality encompasses an area of approximately 39 hectares. The topography is generally flat, low lying, poorly drained and slopes moderately towards the Kouchibouquasis River.

POPULATION: There is no population trend evident during the decade 1971-1981. Census information indicates a 29% increase in population of the Village of St.-Louis-de-Kent occurred during the first half of the past decade (1971-1976) and a 9% decrease in population during the second half of that decade (1976-1981). In 1981, the population of the village was 1,166 and there were 334 occupied dwellings within the municipality.

YEAR	POPULATION
1971	992
1976	1278 (29% increase)
1981	1166 (9% decrease)

WATER SUPPLY: The Village of Saint-Louis-de-Kent has a public ground water supply. One well located off Rue Acadie Street with a depth of approximately 79 m and a diameter of 25 mm (pumping capacity unknown) services approximately 125 residences within the village. The village has one ground level storage tank with a 9,000 litre capacity. Distribution pressure within this system averages 2.4 - 3.8 kg/cm2. This supply is not metered and the village's superintendent of works estimates that this supply is adequate to service an additional 100 dwellings. The old village well (located at the old fire hall) is no longer used as a back-up supply. This well is 80 m deep.

WATER QUALITY: The quality of the village's water supply is good. A chemical analysis of the municipal supply in July, 1983 (Table (3.30) indicates that all parameters are within the guidelines for maximum acceptable concentrations suggested for Canadian Drinking Water Quality, 1978.

An occurrence of well pollution about five years ago in 3 wells along Route 11 below Beausejour Street was apparently caused by underground oil storage tank leakage. Three new wells approximately 73 m have been pollution free.

WASTEWATER TREATMENT: The Village of Saint-Louis-de-Kent is serviced by two wastewater treatment facilities. A 1.3 hectare partially aerated lagoon is located west of Route 11 on the south bank of the Kouchibouquasis River. This plant services approximately 80% of the village. A trickling filter wastewater treatment system (7.3 m diameter) was installed in 1978 on the north bank of the Kouchibouquasis River near the highway bridge. This system now services 15% of the village (30 dwellings). This system has the capacity to service a total of 100 residences. The trickling filter system is bypassed for a period of time during winter because of freeze up. Both waste-treatment systems outlet into the Kouchibouquasis River. The supply is chlorinated during summer months.

Storm and sanitary sewers are separated. Old collection lines are concrete. New lines installed north of the river, along Rue Colonel and Route 11 to the village limits are P.C.V.'s. Operating Conditions of the treatment system are shown in Table (3.31).

There are no major industrial or commercial water users in the village.

FIRE PROTECTION: Water supply for fire protection is secured from the village well. There is one hydrant. The river and small brooks are additional sources of supply for the village's one pumper truck (45 litre capacity) and one tanker truck (5400 litre capacity).;

FLOODING: There is no history of flood damages within the village.

TABLE (3.30) WELL WATER ANALYSIS, JULY 1983

ST. LOUIS DE KENT

Chemical Test	Well	Village Office	Maximum* Concentration Units
Potassium(mg/1)	1.8	1.7	
Calcium (mg/1)	17.	16.	200.
Flouride(mg/1)	.26	L.10	1.5
Sulfate (mg/1)	34.	3.9	500.
Nitrate-Nitrite(mg/1)	.10	.72	10.
Alkalinity(mg/1)	121.	110.	30 to 500
Conductivity (us/cm)	620.	600.	
pH (ph units)	8.2	8.1	6.5 to 8.5
Turbidity(mg/1)	.58	.32	5.0
Nitrite (mg/1)	L.01	.05	1.0
Sodium(mg/1)	94.	98.	270.
Iron(mg/1)	L.05	L.05	0.3
Manganese (mg/1)	L.01	L.01	0.05
Copper (mg/1)	L.01	L.01	1.0
Lead (mg/1)	L.05	L.05	0.05
Zinc (mg/1)	L.01	L.01	5.0
Aluminum (mg/1)	L.10	L.10	
Chloride(mg/1)	70.	64.	250.
Silica (mg/1)	8.	7.7	
Magnesium (mg/1)	1.9	1.9	150.
Hardness (mg/1)	50.271	47.774	120.

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE St-Louis-de-Kent
MUNICIPALITY

TABLE (3.31)

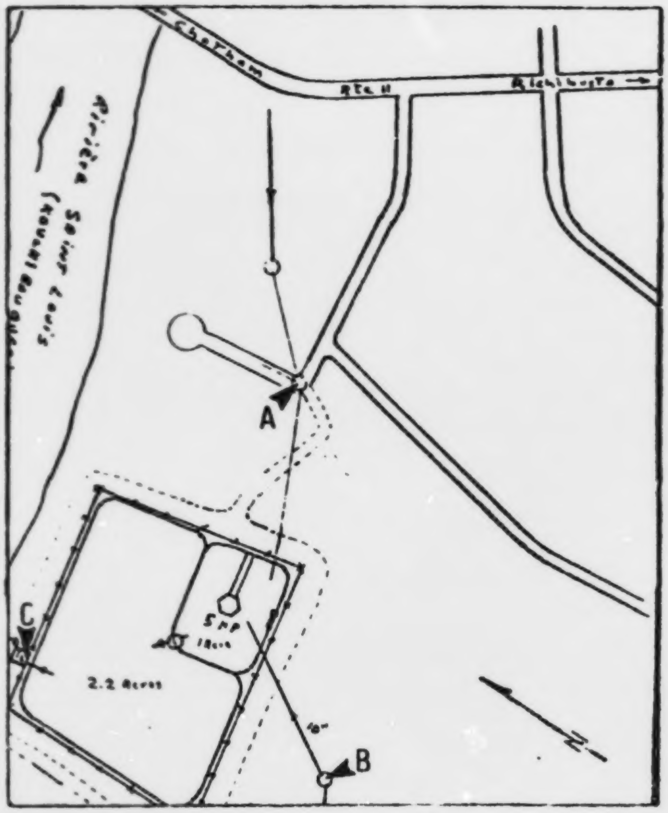
POPULATION 1,279

SURFACE DU BASSIN
POND AREA 1.3 aéré/aerated

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY

MISE EN OPERATION
BEGINNING OF OPERATION 1969

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	190	32	160	80	9.6	6.6	58.0	10.4
1980	165	11	275	51	8.7	5.7		8.2
1981 .		1.19		56		3.8		6.0
1982	200	27	106	36	10.2	5.3	38.0	3.8
*	190	19	235	44	9.8	5.7	41.5	7.1

* Valeurs médianes obtenues les 3 dernières annees
Median values obtained over the past 3 years.

3.19 The Village of Salisbury

LOCATION: The Village of Salisbury is located in the Parish of Salisbury in Westmorland County. It is situated on Route 6 approximately 18 km west of Moncton. Because of its close proximity to the urban centre of Moncton, it is mainly a residential community with no industrial base of its own. The village was incorporated in 1966 and encompasses 10.3 km2 of land area.

Colpitts Woodworkers is the communities, major employer.

POPULATION: The population of the Village of Salisbury has been increasing steadily during the 1970's. The 1981 census population was 1,672, an increase of 16% over the 1976 count of 1,410. There was a total of 509 occupied dwellings in the village in 1981. Salisbury has a population density of 162.2 persons per square kilometre.

YEAR	POPULATION CENSUS
1971	1,070
1976	1,410*
1981	1,673

*Boundary changes from preceding census

WATER SUPPLY: There is no public water supply in Salisbury. Private wells provide the community with good quality water. The water is described by the village clerk as very hard. The Southwest Corner of Route 6 and Route 112 intersection was the location of a reported petroleum contamination of a well supply some years ago (mid 70's).

WASTEWATER TREATMENT: Gravity flow sewer mains direct wastewater to three lagoons. The "main" lagoon located between Route 6 and the Petitcodiac River in the southeast corner of the village has a pond area of 3.6 hectares and services the core area of the village. The east section of the village has a separate 3.8 hectare oxidation pond which services residences along "Fredericton Road" area. A third lagoon is located north of the subdivision off MacWilliam Road. The sewer line does not extend west of Miller Avenue. See Table (3.32) for operating conditions at the village's main waste treatment facility.

FIRE PROTECTION: A 72,700 litre capacity storage tank is used by the fire department. Fire Department officials suggest that this is an adequate supply source for fire protection purposes. In addition, the village has one pumper truck and one tanker truck (capacities unknown).

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Salisbury

TABLE (3.32)

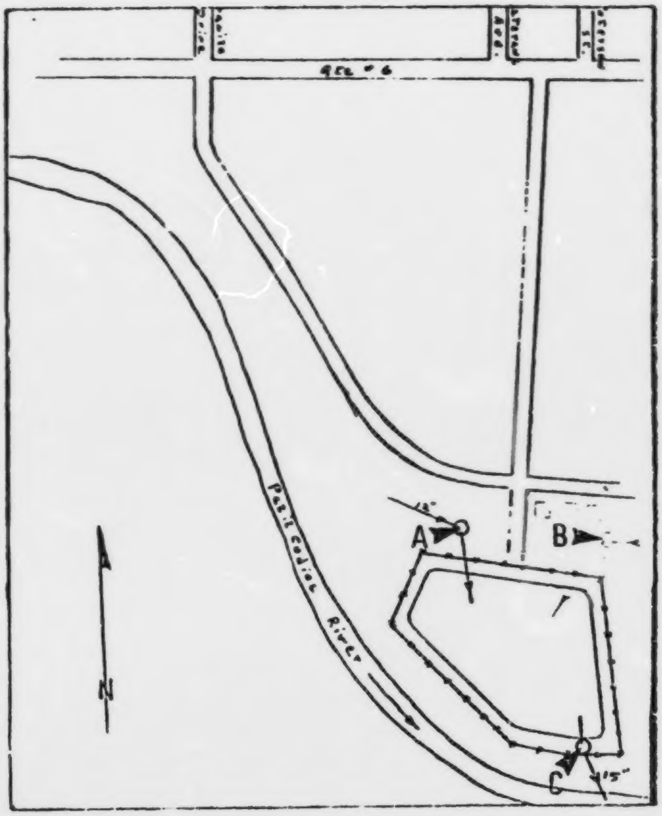
POPULATION 1,410

SURFACE DU BASSIN
POND AREA 3.6

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY 33.2

MISE EN OPERATION
BEGINNING OF OPERATION 1970

INDUSTRIES MAJEURES
MAJOR INDUSTRIES



Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	93	14	81	36	3.6	1.6	16.5	7.7
1980	185		180		8.5			
1981								
1982	38	12	41	20	3.8	2.1	32.5	7.1
*	92	12	102	28	5.5	1.8	32.5	5.9

* Valeurs médianes obtenues les 3 dernières annees.
Median values obtained over the past 3 years.

3.20 The Town of Shediac

LOCATION: Located north of Route 15 at the mouth of the Scoudouc River in Shediac Harbour, the Town of Shediac is situated in Shediac Parish, Westmorland County. Shediac is approximately 32 km east of the City of Moncton via Route 11. The town serves as a regional service centre, a dormitory community for greater Moncton, a summer place of residence and a tourist resort area. The Town of Shediac was incorporated in 1903.

TOPOGRAPHY: The general topography of the area can be described as low with gently rolling and flat land sloping gradually towards Shediac Harbour. Most of the land located north of Route 15 is below the 30 metre contour level. The drainage pattern gives rise to numerous streams and creeks which discharge into the harbour and bay. Among these are the Scoudouc River and the Shediac River. Most of the streams discharge directly onto the beach. There are some natural lagoons and marshes surrounding the harbour and bay.

GEOLOGY: A thick sequence of alternating sandstone and shale beds of Carboniferous age underly the Shediac area. There are the rocks which are found in a broad basin which covers most of the eastern and central portion of the Province of New Brunswick.

HYDROGEOLOGICAL STUDY: Good well yields can be obtained in most parts of the Town of Shediac. Good quality groundwater is generally available from the sandstone aquifers in and around Shediac. Since the individual layers in the carboniferous succession wedge in and out of each other laterally, the various sandstone layers are generally connected hydraulically. The many impermeable interbedded shale units in the succession underlying the Shediac area provide an effective natural filtration and purification system and impede the entry of salt water into the aquifer. There is also a large potential for recharge of fresh water of the aquifer in the Shediac area. (Atlantic Groundwater and Geophysics Ltd., 1977).

POPULATION: The major part of the incorporated area in the municipality of Shediac is sparsely populated. The main settlement area is along the shore (Shediac Harbour) north of Route 133 and east of Scoudouc River.

The Town of Shediac over the past 50 years has experienced a slow but steady population growth. However, this rate of growth did not keep pace with that experienced by either Shediac Parish or the Province as a whole. The 1981 census count for Shediac was 4,285 persons in a total of 1,289 occupied dwellings. This is a slight increase (less than 2%) over the 1976 count of 4,216 persons.

YEAR	CENSUS COUNT
1931	1883
1941	2147
1951	2010
1961	2159
6 6 9 1	2134
1971	2203
1976	4216
1981	4285

WATER SUPPLY: The Town of Shediac has had a public water supply since 1905. Three bedrock wells (Figure 3.7) each with an approximate depth of 122 m are equipped with two submersible pumps and one line shaft pump. The three wells have a total pumping capacity of 57 l/s. This is able to satisfy the town's average water demand of 2.25 million litres per day and a maximum water demand of 2.73 million litres per day. The town's maximum water requirement represents more than a 45% increase over normal (average) demand. Since the permanent resident population of the town is 4285, the average per capita consumption can be calculated to the approximately 415 l/c/d. See Table (3.33) for well data.

An estimated 75% of the total water flow in Shediac is to residential users, 10% to commercial, 10% to industrial and 5% to institutional. The town had one elevated 1.64 million standpipe at the Well #2 location. A second standpipe is planned for the Well #3 location. It will have a 1.36 million litre holding capacity. Water demand is metered at the source.

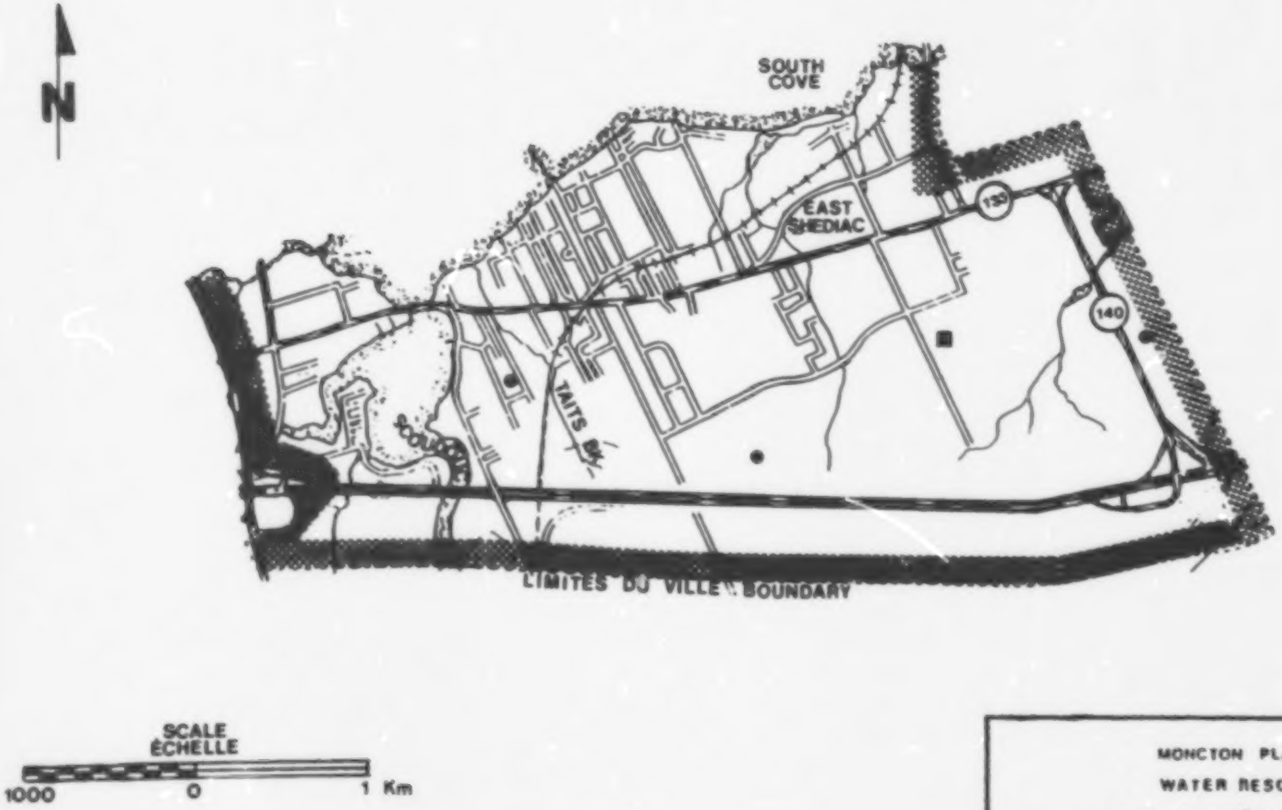
There are two major users of water within this municipality. Water used by Shediac Lobster Shop Ltd. , a fish (lobster) processor, varies depending on the season. The Federal Fisheries Laboratory is another major user. The water demand of these users is not metered.

Growth of the already established fish processing industry would increase water demand on the town's supply. The development of a planned industrial park would influence servicing requirements especially with regard to water availability for fire fighting.

An increase in day to day supply demand is not anticipated by town officials except in the event of incorporation of outlying areas with their summer resident population.

ENVIRONMENT N.B.
ENVIRONNEMENT N.-B.

WATER RESOURCES BRANCH
DIRECTION DES RESSOURCES EN EAU


N
SOUTH COVE
EAST SHEDIAC
130
140
TAITS BK.
SCOUDOUC
LIMITES DU VILLE \ BOUNDARY
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LEGEND
LÉGENDE

- ● WELL
  PUITS
- ■ OBSERVATION WELL
  PUITS OBSERVATION

MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

WATER SOURCES
SHEDIAC
SOURCES D'EAU

FIG. 3.7

TABLE (3.33) WATER SUPPLY IN SHEDIAC

WELLS	FIRST YEAR IN PRODUCTION	TYPE OF AQUIFER	WELL DEPTH (m)	WELL DIAMETER (cm)	PUMPING CAPACITY (1/s)
Well #1	1961	Bedrock	130	25	30
Well #2[1]	1972	Bedrock	140	25	17
Well #3[2] (Ohio Rd.)	1981	Bedrock	122		14

[1] Location of the 1.64 million litre standpipe at intersection of Brian Bridge & Sackville St.

[2] Location of the proposed 1.36 million litre reservoir. This supply balances the demands between east and west sections of Shediac. The local permeability at this location is unusually variable. Manganese concentrations from this well water exceed the recommended level.

WATER QUALITY: Town officials describe the quality of their municipal supply as "excellent". The supply system was equipped with a stand-by gas chlorinator which was replaced in 1984 with a more convenient liquid type. Water from Well #1 is slightly alkaline (8.7 pH) and water secured from Well #3 during the summer of 1982 had a manganese content of 0.16 mg/l. Refer to Table (3.34) for a chemical analyses of the Town of Shediac's water supply.

DISTRIBUTION: The water supply is gravity distributed. A 1.65 million litre standpipe is adjacent to Well #2 location. A proposed reservoir holding 1.36 million litres at Well #3 location serves as a backup supply for development in the east township area. The reservoir tank has an outlet pressure of 2.7 kg/cm2, while the pressure at Main St. locations is 3.9 kg/cm2 and Shore Drive area is 5.2 kg/cm2.

WASTEWATER TREATMENT: Shediac was one of the first New Brunswick communities to have a sewage treatment plant (1948). The municipal primary treatment plant is a 2-cell aerated lagoon approximately 8.1 hectares in area. Provision has been made to include a third lagoon at such time as this is needed. The sewage collection system services the greater Shediac Service Commission area, i.e. it includes POinte-Due-Chene and the surrounding area. The main lines of the system are gravity operated and there are eight lift stations. Storm drainage is separated from sewage drainage. The effluent is chlorinated and the lagoons discharge into Northumberland Strait. See TAble (3.35) for operating conditions at the town's treatment plant.

FIRE PROTECTION: The Town of Shediac has 175 fire hydrants.

TABLE (3.34) CHEMICAL ANALYSIS OF WATER SUPPLY IN SHEDIAC, N.B., AUGUST, 1982

PARAMETER	WELL #1	WELL #2	WELL #3 (Ohio Rd Well)	Maximum Accept-** able Concentratio
Potassium(mg/1)	.82	1.0	.96	
Calcium(mg/1)	4.6	14.	29.	200.
Flouride(mg/1)	.24	.24	L.1	1.5
Sulfate(mg/1)	15.	12.	5.8	500
Nitrate(mg/1)	L.01	L.01	L.01	10.
Alkalinity(mg/1)	144.	146.	113.	30 to 500
Conductivity(us/cm)	525.	660.	320.	
pH	*8.7	8.4	7.8	6.5 to 8.5
Turbidity (NTU)	.20	.29	.24	5.0
Nitrite(mg/1)	L.01	L.01	L.01	1.0
Sodium (mg/1)	91.	100.	16.	270.
Iron(mg/1)	L.05	.10	L.05	0.3
Manganese(mg/1)	L.01	.01	*.16	0.05
Copper (mg/1)	L.01	L.01	L.01	1.0
Lead(mg/1)	L.05	L.05	L.05	0.05
Zinc(mg/1)	L.01	L.01	L.01	5.0
Aluminum(mg/1)	L.10	L.10	L.10	
Chloride(mg/1)	46.	82.	12.	250.
Silica (mg/1)	9.3	9.1	12.	
Magnesium (mg/1)	.82	2.1	4.7	150.
Hardness(mg/1)	14.862	43.604	91.574	120.

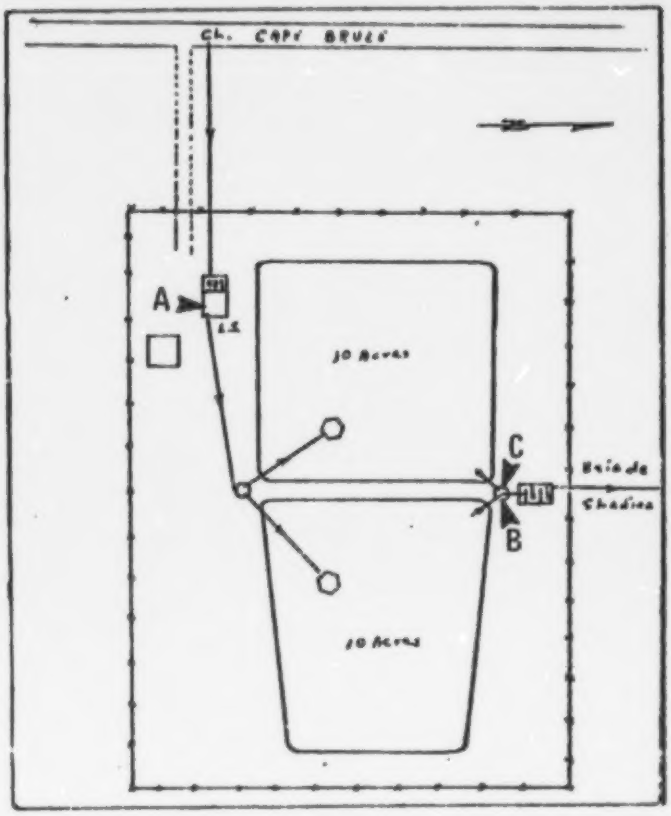
* Exceeds Guidelines for Canadian Drinking Water Quality, 1978

** Guidelines for Canadian Drinking Water Quality, 1978

BASSIN DE STABILISATION
WASTE STABILIZATION POND

MUNICIPALITE
MUNICIPALITY Shédiac

TABLE (3.35)



POPULATION 4,216

SURFACE DU BASSIN
POND AREA 8.1 aéré/aerated

CHARGE KG/HECTARE/JOUR
LOADING KG/HECTARE/DAY

MISE EN OPERATION
BEGINNING OF OPERATION 1971

INDUSTRIES MAJEURES
MAJOR INDUSTRIES

Valeurs médianes obtenus depuis 1979
Median values obtained since 1979

	BOD/DBO		SUSPENDED SOLIDS MATIERES EN SUSPENSION		TOTAL PHOSPHORUS PHOSPHORE TOTAL		TKN/ATK	
	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)	INFLUENT ENTREE (mg/ℓ)	EFFLUENT SORTIE (mg/ℓ)
1979	75	21	57	28	3.0	1.5	13.0	7.8
1980	47	11	71	31	2.7	2.0	11.0	10.1
1981	1.37	14	50	46	2.3	1.4	14.8	7.9
1982	17	23	28	27	1.2	1.9	11.0	9.9
*	38	14	40	35	1.8	1.8	11.5	9.2

* Valeurs médianes obtenues les 3 dernieres annees.
Median values obtained over the past 3 years.

CHAPTER FOUR

WATER MANAGEMENT CONSIDERATIONS

4.1 Introduction

Historically, the Province of New Brunswick has experienced virtually a complete absence of controls on the withdrawal and use of water, from either surface or underground sources. This fact reflects the Province's comparative wealth of water resources. However, in recent years demand for water has increased to the point where this situation is changing.

In fact, the water cannot be said to be managed unless there is a degree of control over the way it is used. In this regard, reference can be made to the Water Use Control Strategy for the Province of New Brunswick, prepared by Montreal Engineering Company Limited, 1976.

Generally, the major concern of a water user is to obtain water of suitable quality and in sufficient quantity to satisfy his needs at the lowest possible cost. For the individual water user, remote from a stream or lake, a well usually is the only supply available which needs these criteria.

In developing considerations for use and management of water in the region, neither groundwater nor surface water sources can be studied independently. For every proposed new water need, it is essential that the cost, advantages and disadvantages of both alternative sources be considered. There are, as well, certain situations where joint use of both resources may be required.

The first problem in many areas is to determine the extent of the available resource. That is, one must first find out if enough surface water or groundwater is available for a proposed use. Only then can a comparison of the relative quality and the cost of using the resource be evaluated.

Another important factor that should be considered in relation to a water supply is the security of the source. Any major user of water, especially a municipality, will want to select a supply source which is secure from loss or failure; or which can be made secure. The security of the source must include both quality and quantity aspects.

The relationship between water quality and water quantity should be acknowledged at this point. The ultimate use of water is determined by a combination of both factors, and it is superficial to treat one subject in isolation of the other. The downstream user will be limited by both the quantity and quality of the effluents upstream and by the quantity of water available for diluation.

Perhaps the most important step in water management is the protection of the resource. Such protection may include taking measures against unsatisfactory waste disposal practices, detrimental land use practices, biocides, unsuitable water-related works and activities, and unsuitable developments. It may also include the protection of the community itself from the destructive effects of water. This type of protection includes life and property damage due to floods, and the errosive effects of water on the land.

4.2 Protection of the Water Resource

In the Moncton Planning Region, the majority of the municipalities are situated along the major rivers in the region. Considerable impact on the quality of water has been observed within these streams as a result of the discharged domestic and industrial waste. Consideration should be given to the installation of waste treatment facilities in order to improve the region's water resources.

Today, water consumption for domestic purposes averages about 400 litres per day per person. Growth of some urban areas has required hundreds of private wells in limited areas. When surface water is used, large watershed areas are required to meet urban, domestic and industrial demands. As larger quantities of water are used, larger amounts of liquid wastes are generated. Dumping inappropriate amounts of waste into the nearest stream is no longer acceptable because it will ruin the supply for the next downstream user. Waste does not enter just water, but an aquatic ecosystem. Each ecosystem has a certain capacity to receive and assimilate these wastes. This capacity is determined by the physical, chemical and biological interactions within the ecosystem as well as the type of the waste discharged. Through an understanding of the characteristics of an aquatic ecosystem, water resource managers may develop the necessary means to gain maximum beneficial water use while allowing only minimal damage to the ecosystem.

The estimation of the assimilative capacity of a stream should, therefore, include adequate examination by an ecologist.

Today's society also uses an ever-increasing variety and volume of chemicals, which are beneficial only so long as they are used carefully and for the intended use. Salt, for example, is used to melt highway ice, but if used in excessive amounts it can impact on adjacent streams and wells.

Salt storage facilities should provide adequate control of any resulting brines from both the salt and the salt-sand mix. This control in developed areas should include the complete covering of all materials so as to prevent contamination of wells. If, however, road salt must be stored near streams, every possible provision should be made to minimize leachate discharge and to ensure that it is sufficiently diluted by the stream. Road salt applications in winter should be properly timed, and quantities used kept azt the minimum absolutely necessary for safe vehicle operation. This would further reduce contamination of surface water and groundwater in such areas.

The greatest care should be exercised in the handling of all hydrocarbon fuels, particularly near private or municipal wells. Any such pollutants present on the land surface will infiltrate rapidly to the water table. All petroleum-product tanks should be checked on a regular basis to identify leaks before they cause serious contamination of groundwater. Impermeable catchments should be constructed to trip spillage around above-surface tanks.

The Province is responsible for the protection of the quality of both surface water and ground water. Regulations under the Clean Environment Act form the basis for the water resources protection in the province. These expressly forbid contamination and permit penalties to be levied where a polluter is convicted.

There are three regulations under the Clean Environment Act which are directly involved with the protection of the water resources. These are the Water Quality Regulation, the Water Well Regulation, and the Watercourse Alteration Regulation.

The Water Quality Regulation prohibits the contamination of any water of the province and the construction of any water supply or distribution system without approval. This regulation also makes provision for the protection of any public water supply, whether from a surface source or from wells. Section 23 permits the definition of a protected area, where the Minister may designate certain activities as harmful, and therefore not allowed. For example, if a lake provides the water supply for a given town, boating, swimming and washing may be controlled or forbidden on that lake. Obviously, each public supply is unique and the desired type and level of protection should be decided on an individual basis.

The Water Well Regulation forbids the construction of any well so near to a source of contaminant that contamination of the well by groundwater flow or seepage may take place (Section 19). The regulation defines the sources of contaminant and specifies the allowable distance, away from these sources, at which a well may be located. Also, Section 20 of the regulation states that no source of contaminant shall be constructed any nearer to a well than the distance prescribed by the regulation unless the well is abandoned. The regulation also contains a provision that reports be filed containing construction details on all wells drilled in New Brunswick.

The Watercourse Alteration Regulation was prepared to ensure that the potential effects of a watercourse alteration are adequately considered at the design stage and it is intended to minimize short-term and long-term adverse effects to surface water quality, to aquatic habitat and to property owners. A permit is required for most types of alteration of any watercourse in the province. The New Brunswick Fisheries Act and the Canada Fisheries Act also require that approval for stream alterations be obtained. However, it is only necessary to apply once to the N.B. Department of the Environment; the review process for this application involves the federal and provincial fisheries interests as defined in the Fisheries Acts.

The Watercourse Alteration Regulation also prohibits the removal of sand, gravel or similar material from the bed of a river, lake or stream for the purpose of sale or use in a commercial product. Very few watercourses in New Brunswick could withstand even small amounts of instream mining and still have adequate spawning area left to maintain an adequate salmonid population or retain any channel stability.

Overall, the planning region has adequate water resources but it should be remembered that these resources are required for a variety of uses. Through water management, conflicts in water use can be resolved and the valueable resource protected for the future.

4.3 Protection of the Water Supply Watersheds

Considerable effort and funds have been invested by the Federal Government, the Province and municipal governments in the development of water supplies. It has not been fully appreciated that these systems can easily be contaminated and ruined by carelessness, ignorance or lack of attention.

The concept of the "protected area" was mentioned in the previous section under discussion of the Water Quality Regulation. A protected area refers to a surface water drainage basin or a site of groundwater recharge where measures are taken above and beyond the normal health, environmental and subdivision controls which apply to the province as a whole. The organization and management of a protected area will demand a great deal of cooperation between the several water users whose interests may be in conflict. A variety of possible methods are available. One approach s for a municipality to extend its boundaries to include the area requiring protection. It is then relatively simple to zone the land in a way that is compatible with water supply. Another approach, if the area is not too large, is outright purchase. This offers the greatest control of the watershed. A third approach, if the land is owned by the Crown, is to arrange for special status and administration of the water supply area as is the case of the Musquash Watersheds west of Saint John City. All of these approaches are now being used or considered in New Brunswick.

There are two levels of protection suggested in this report. The high level of protection applies to those basins which are presently being used or have the greatest potential for use as a municipal water supply.

The low level of protection applies to those basins which are presently being used for an individual water supply plus other basins where development of a watercourse as a source of water is judged feasible. Both levels of protection should involve:

1. The minimization of stream sedimentation by:
    - (i) ensuring all highway ditches are property graded and seeded;
    - (ii) urging good agricultural practices such as contour ploughing and sedimentation control structures;
    - (iii) encouraging the selective harvesting of mature and over-mature timber rather than clear-cutting;
    - (iv) prohibiting gravel mining in or near a watercourse or its flood plain;
    - (v) ensuring watercourse alterations are properly designed and constructed; and
2. The reduction of pollution hazards within the basin by:
    - (i) maintaining adequate sewage and wastewater treatment plants for all communities and industries;
    - (ii) controlling the aerial or ground application of pesticides;

(iii) controlling the storage of pesticides, hydrocarbons, paints, or any toxic chemicals or compounds, and

(iv) by prohibiting the storage of any compound hazardous to water quality within 30 m of the bank of a watercourse or upon its flood plain.

The high level of protection should also include land use controls which should strictly control the construction of new subdivisions and industries within the drainage basin. Land under public ownership should be preserved in a suitable state and the percentage of the drainage area under public ownership may be increased by purchase of expropriation. Water production, consumption and quality should be regularly monitored and recorded.

4.4 Protection of Public Water Supply Wells

Protection of water supply wells is somewhat similar to the protection of watersheds and recharge areas but the problems encountered are different. For example, every town using wells should devise a method to prevent hazardous development within 300 m to 500 m of its well. Here "development" means such things as septic tanks or commercial establishment with storage of any materials which could contaminate water supplies. Should this prove impossible, the presence of specific contaminants should be forbidden through zoning; gasoline or oil storage, septic tanks, salt storage, landfills, etc.

Continued population growth is indicated in some areas within the region and the use of individual supplies makes management and protection of the groundwater resource difficult. Probability of aquifer contamination increases with the number of wells drilled and mutual interference between wells becomes a significant consideration as density increases.

More important, however, is the very substantial lack of sound data on the actual capacity of many of these sources. This is particularly of concern in the case of groundwater sources. In the case of surface water source there is usually some reasonably sound theoretical basis for calculating the likely yield. This is rarely the case with a groundwater source and there is no adequate substitute for proper exploration and well evaluation at the time of construction.

In order to overcome some of this lack of groundwater data in the Province of New Brunswick, a groundwater monitoring network is being developed.

4.5 Flood Plain Consideration

Severe flood events are a less common occurrence in the Moncton Planning Region than elsewhere in New Brunswick, but serious and damaging flood events do occur and flooding should not be overlooked by local authorities and government agencies concerned with public health and safety, and the risks to property.

Unlike other parts of the Province, flood events in the Moncton Planning Region can occur throughout the calendar year. Much of the flooding is due to heavy rainfall and high tides, although snowmelt, ice jams, and other factors sometimes contribute to flood occurrence.

One of the worst recorded flood events in the Moncton Planning Region occurred at the beginning of April 1962. The flooding was a result of heavy rainfall.

In the Moncton area, several residences were evacuated, including at least six residences on New Street. Several streets were inundated; huge ice cakes damaged several parked cars, and were left stranded along many of these streets. The underpass on the Salisbury Road and West Main STreet were submerged. Communications and business activities were disrupted because of flooded roads and commercial establishments.

During this April 1962 flood event, extensive property damage occurred in Sackville and surrounding area. Commercial establishments in the eastern end of town that were flooded are Black's Hardware, Chignecto Bakery, Armo Drainage and Metal Products, and two warehouses near the railway tracks. Streets were covered with water and at least 50 people were evacuated from houses in one section of town. Most of the town was without power and the drinking water was contaminated for several days. The C.N.R. was flooded in several places within the town and a washout occurred between Sackville and Amherst.

Elsewhere within the Moncton Planning Region, three bridges were washed out. These bridges were at Parkindale, College Bridge and near Shediac. Highway No. 2, between Moncton and Sackville, was submerged at Fox Creek, Breau Creek, and Frosty Hollow during the April 1962 flood event.

The April 1962 flood event was one of the worst that effected the Moncton Planning Region, but, as can be noted from Table 4.1, several other flood events have occurred.

TABLE (4.1) HISTORICAL FLOOD EVENTS IN THE MONCTON PLANNING REGION

Contributing Cause FLOOD EVENT	Heavy or Prolonged Precipitation	Mild Temperature	Spring Freshet	Unusually Late Breakup	Unusually Early Breakup	Ice Jam	Gales and Strong Winds	High Tides	Drainage	DAMAGE
October 9-13, 1869	X						X	X		Saxby Gale; bridges and buildings were washed away in Moncton & Hillsborough areas.
March 18,23, 1902	X	X			X	X				Carlisle Mines bridge swept away. Moncton Area-railways washed out and some highway damages. Hillsborough-bridge swept away.
Jan 4-7, 1909	X	X				X				Kouchibouguac-both steel spans of bridge carried away. Coates Mill-dam broke carrying 500,000 feet of logs away.
April 14-17, 1909	X		X							Three bridges swept away on Richibucto River.
Aug 8-12, 1912	X									Destroyed hay crop on Tantramar Marshes. Two small dams broke at Silver Lake.
April 15-20, 1920	X	X								In Moncton, Humphreys Dam broke flooding areas downstream.
Aug 26-28, 1922	X									A dam broke and destroyed a portion of a highway bridge at Lewisville.
April 29-May 9, 1923	X	X	X							CNR mainline flooded at College Bridge and Upper Dorchester resulting in a halt of rail traffic between Moncton and Halifax.
September 14-20,1932	X						X			Three spans of the Upper Dorchester Bridge of the Memramcook River collapsed.

TABLE (4.1) continued

Contributing Cause FLOOD EVENT	Heavy or Prolonged Precipitation	Mild Temperature	Spring Freshet	Unusually Late Breakup	Unusually Early Breakup	Ice Jam	Gales and Strong Winds	High Tides	Drainage	DAMAGE
Oct 24-27, 1933	X									Bridge over the Big Aldouane River near Richibucto was swept away.
March 16-25, 1936	X	X			X					Five Points Bridge at Little River near Salisbury was damaged.
Sept 17-20, 1940	X						X	X		Bridge carried away at Buctouche. Basement flooding and heavy power line damage in Moncton.
April 20-24, 1950	X		X			X		X		Highways near Richibucto and Moncton damaged or blocked.
Feb 8-11, 1953										The highway from Moncton to Amherst was inundated between Westcock and Frosty Hollow.
March 26-April 3, 1953	X	X	X			X				Route 14 impassable from Mechanic Settlement to Fundy National Park.
March 31-April 14, 1962	X			X						Moncton and vicinity. Several flooded homes evacuated West Main Street and several other streets were submerged. Earthern dam at Jones Lake broke. Sackville. At least 50 people forced to evacuate from homes. Several commercial establishments in the eastern end of town flooded. Drinking water became contaminated. Most of the town was without electric power. Elsewhere. Bridges over the Memramcook River at College Bridge and a bridge over the Shediac River were washed away. Highway #2 between Moncton and Sackville submerged. C.N.R. roadbed washouts. Flooding at Middle Sackville.

TABLE (4.1) continued

Contributing Cause FLOOD EVENT	Heavy or Prolonged Precipitation	Mild Temperature	Spring Freshet	Unusually Late Breakup	Unusually Early Breakup	Ice Jam	Gales and Strong Winds	High Tides	Drainage	DAMAGE
Nov 22-25, 1962	X									Sackville Streets flooded. Highway no. 2 inundated.
Oct 20-22, 1968	X						X	X		Hurricane Gladys, resulted in heavy rains. Six families in Richibucto area forced from homes and several village streets flooded.
Dec 10-11, 1975	X									Small section of C.N.R. roadbed between Amherst and Moncton washed out.
Jan 27-28, 1976	X	X								Basement flooding in Riverview.
January 1978					X			X		Railway tracks between Sackville and Aulac blocked by ice cakes.
Jan 10-11, 1978	X						X	X		Rocklyn Bridge, described as the world's second largest covered bridge, was destroyed. This bridge was at upper Dorchester. Businesses and fur farm in Moncton and area were inundated.
Jan 25-28, 1978	X	X	X							Basement and street flooding in Moncton.
Jan 8-9, 1979	X		X							In Dieppe, Fox Creek bridge and portion of Dover Road inundated.
Jan 29-31, 1979	X							X		Basement flooding and traffic interruptions in Riverview.

Action by Local Authorities

Local authorities may participate in flood damage reduction efforts by documenting flood events, cooperating in flood contingency planning, providing flood information, and creating development controls.

Information on past flood events can be useful when delineating flood hazard areas, assessing flood damages, and preparing flood contingency plans. Therefore, it is important that flood events will be well documented as they occur.

Photography can be a good method of documenting a flood event. Enough photographs should be taken so as to completely describe a flood event, including the areal extent of flooding, the associated flood water levels (related to some identifiable object), and flood damages. Information should be provided with each photograph as to the photographer, the purpose of the photograph, the location from which the photograph was taken, the site shown in the photograph, the name of the watercourse, the time at which the photograph was taken, and the date.

Marking of high water marks, and the determination of water levels by levelling from Geodectic vertical control monuments are also useful means of documenting flooding. Municipal officials should also become aware of any existing disaster plans for their community. If there is a need for flood contingency planning, officials of the municipality should contact staff of the Emergency Measures Organization whose assistance would be readily available.

Flat or gently sloping flood plain land along rivers and streams often attract home builders and developers who are unaware of the flood hazard. By providing these people with information on the flood hazard (perhaps when contacted with regard to building permits), local authorities may be able to reduce the risk to human life and the potential for flood damages.

There are several locations within the Moncton Planning Region where flooding occurs. These areas are often very attractive to the developer. A consequence of flood plain development is direct flood damage during flood events. It is important that development be avoided where there is significant flood risk to life or property. In areas of known flood hazard, local authorities should control the type and/or design of developments - possibly by revisions to their zoning, subdivision or drainage by-laws.

The Canada-New Brunswick Flood Damage Reduction Program

The Province of New Brunswick and the Federal Government entered into a "General Agreement Respecting Flood Damage Reduction" on March 31, 1976 with the objective of reducing potential damages on flood plains. The Agreement recognizes that the potential for flood damage can be reduced by a number of measures, including control of the uses made of areas prone to flooding.

A sub-agreement entitled "An Agreement Respecting Flood Risk Mapping" was also signed on March 31, 1976. Under the terms of this Agreement, selected flood-prone areas in the Province are being mapped and flood-risk zones delineated. They will ultimately be designated as areas wherein only certain approved development may take place.

Another sub-agreement entitled "An Agreement Respecting Sutdies for Flood Damage Reduction" was also signed in 1976. Under the terms of this Agreement, studies may be carried out for selected areas to determine the best measures to reduce damages as a result of flooding in the future.

No flood studies or flood risk mapping for communities with the Moncton Planning Region have been undertaken as part of the Canada-New Brunswick Flood Damage Reduction Program. However, design flood flows have been determined for the Moncton and Sackville areas as part of a regional flood frequency analysis for the entire Province.

4.6 Monitoring the Water Resource

An important role of the protection and management effort is monitoring the fluctuations in water conditions so that predictions can be made. In the field of hydrology, an assessment of water availability or the possibilities of flooding can be made by the collection of climatological, streamflow and groundwater data. However, data collection is usually an expensive operation and care must be taken to obtain the data most useful to those managing or interested in the water resource.

4.6.1 The Climatological Network

Climatological data is presently collected at several selected sites by Atmospheric Environment Services, Environment Canada, (A.E.S.) observers. These climatological sites are part of the national climatological network. In most cases, the federal program is carried out in conjunction with a cooperative agency. Presently, there are 9 active A.E.S. Climatological Stations within the region.

There are also climatological records available for several stations near enough to be useful for climate studies of the planning region. Reference can be made to the Climatological Station Data Catalog Atlantic Provinces.

A network of seasonal Climatological Stations has been established in the province by the New Brunswick Department of Natural Resources. Three of these stations are located within the Moncton Planning Region at St-Louis-de-Kent, St. Paul and Petitcodiac. The data from these stations are utilized in determining the fire weather index for the planning region. The data is archived on microfilm but is not available at the present time in a published form. The Forest Branch of the Department of Natural Resources is currently accumulating and collating data for publication.

The density guideline for ordinary climatological stations is a minimum separation between stations of 40 km. An ordinary climatological station is one in which observations are made at least once daily; these include daily readings of extreme temperature and/or amounts of precipitation. (In Canada, twice-daily readings are strongly recommended as once-daily readings bias the observations).

There is one principal station, Moncton A, in the Moncton Planning Region. This station is lcoated at the Moncton Airport. a principal station is one at which hourly readings of climatological parameters are made.

Climatological data are forwarded to the A.E.S. Atlantic regional headquarters for checking and processing. The data are then forwarded to the national headquarters (Toronto) for final quality control, processing, publication and archiving. Climatological data are published in Monthly Record of Meteorological Observations in Canada (to 1977) and Monthly Record - Meteorological Observations in Eastern Canada (1977 on) and several other publications of the Atmospheric Environment Service of Environment Canada. Normals of precipitation and temperatures are published in two separate A.E.S. publications. These data are of use to those making decisions with respect to forestry, agriculture, water resources, highway and building design, power generation, and for the generalized statistical evaluation of the influence of climate. Hydrologists utilize the data for determining design storms used in estimation of the maximum probable flood.

4.6.2 The Hydrometric Network

As defined here, the hydrometric network presently consists of those stream-gauging stations where the amount of sediment, the water level (stage) and/or the volumetric rate of flowing water (discharge) are measured and those observation wells where the nonpumping water level is observed.

There records are mainly used by:

1. hydrologists in estimation of extreme flow events (floods and drought);
2. engineers in hydraulic design of bridges, culverts, dams and water control structures;
3. agriculturalists in estimating water availability for irrigation;
4. resource managers and government agencies responsible for resource development and management decisions; and
5. many others who utilize or are directly affected by the water resource.

Streamflow data are collected at selected hydrometric sites by the Water Survey of Canada under agreement with the Province of New Brunswick.

At the present, there are ten active hydrometric stations in the Moncton Planning Region. The length of record at these stations vary from 6 to 34 years and their drainage areas range from 34 to 1,050 sq. km.

There are also streamflow records available at three inactive stations within the region and at a few other stations outside the planning region but near enough to be useful in water resource studies in the region. A tabulated list of active stations is also presented in Appendix C, Table (6.1). Streamflow data for all hydrometric stations, with the exception of water level stations, can be obtained from publications of the Water Survey of Canada.

It is too expensive to gauge every watercourse but estimations can be made based upon the hydrometric records of similar nearby watercourses. The design of a stream-gauging network should therefore include a significant number of basins in the planning region.

Groundwater monitoring is used primarily by provincial water resource managers and consultants acting on behalf of municipal and industrial clients. As mentioned earlier, a hydrometric groundwater network is under consideration by the New Brunswick Department of the Environment for the entire province.

The hydrometric network is under continual review by the water management agencies of the Federal and Provincial governments. A review of the hydrometric network was releases in 1979 (Environment Canada an the New Brunswick Department of the Environment, 1979). These agencies would welcome the suggestions of engineers, hydrologists and other interested in the adequacy of the hydrometric network.

LIST OF CONTRIBUTORS

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APPENDIX A

GENERAL INFORMATION

Table A-1

FLOW EQUIVALENTS

UNIT	CUBIC METER PER SECOND	LITER PER SECOND	CUBIC METER PER DAY	CUBIC METER PER YEAR	CUBIC FOOT PER SECOND	CUBIC FOOT PER DAY	IMPERIAL GALLONS PER MINUTE	IMPERIAL GALLONS PER DAY	MILLION IMPERIAL GALLONS PER DAY	ACRE-FEET PER DAY	ACRE-FEET PER YEAR	U. S. GALLONS PER MINUTE	U. S. GALLONS PER DAY
1 m^3/s	1	999.97	86.400E 3	31.558E 6	35.315	3.0521E 6	13.198E 3	19.005E 6	19.005	70.046	25.584E 3	15.850E 3	22.824E 6
1 l/s	1.0000E-3	1	86.402	31.558E 3	35.315E-3	3.0512E 3	13.198	19.006E 3	19.006E-3	70.048E-3	25.585	15.851	22.825E 3
1 m^3/day	11.574E-6	11.574E-3	1	365.25	408.73E-6	35.315	152.76E-3	219.97	219.97E-6	810.71E-6	296.11E-3	183.45E-3	264.17
1 m^3/year	31.688E-9	31.687E-6	2.7378E-3	1	1.1191E-6	96.686E-3	418.22E-6	602.24E-3	602.24E-9	2.2196E-6	810.71E-6	502.27E-6	723.26E-3
1 cfs	28.317E-3	28.316	2.4466E 3	893.61E 3	1	86.400E 3	373.73	538.17E 3	538.17E-3	1.9835	724.46	448.83	646.32E 3
1 ft^3/day	327.74E-9	327.73E-6	28.317E-3	10.343	11.574E-6	1	4.3256E-3	6.2288	6.2288E-6	22.957E-6	8.3850E-3	5.1948E-3	7.4805
1 Igpm	75.768E-6	75.766E-3	6.5464	2.3911E 3	2.6757E-3	231.18	1	1.4400E 3	1.4400E-3	5.3072E-3	1.9385	1.2010	1.7294E 3
1 Igpd	52.617E-9	52.615E-6	4.5461E-3	1.6605	1.8582E-6	160.54E-3	694.44E-6	1	1E-6	3.6856E-6	1.3462E-3	833.99E-6	1.2010
1 MIGD	52.617E-3	52.615	4.5461E 3	1.6605E 6	1.8582	160.54E 3	694.44	1E 6	1	3.6856	1.3462E 3	833.99	1.2010E 6
1 ac-ft/day	14.276E-3	14.276	1.2335E 3	450.53E 3	504.17E-3	43.560E 3	188.42	271.33E 3	271.33E-3	1	365.25	226.29	325.85E 3
1 ac-ft/yr	39.087E-6	38.086E-3	3.3771	1.2335E 3	1.3803E-3	119.26	515.87E-3	742.86	742.86E-6	2.7378E-3	1	619.54E-3	892.13
1 USgpm	63.090E-6	63.088E-3	5.4510	1.9910E 3	2.2280E-3	192.50	832.68E-3	1.991E 3	1.9910E-3	4.4192E-3	1.6161	1	1.4400E 3
1 USgpd	43.813E-9	43.811E-6	3.7854E-3	1.3826	1.5472E-6	133.68E-3	578.25E-6	832.67E-3	832.67E-9	3.0689E-6	1.1209E-3	694.44E-6	1

Table A-2

ABBREVIATIONS AND CONVERSIONS

MIG	=	million Imperial gallon	1 MIG	=	4546.09m^3
MIGD	=	million Imperial gallon per day	1 MIGD	=	0.0526 m^3/s = 1.858 cfs
cfs	=	cubic foot per second	1 cfs	=	0.0283 m^3/s
csm	=	cfs per square mile	1 csm	=	10.933 litre/s.km^2
Igpcd	=	Imperial gallon per capita per day	1 Igpcd	=	4.546 litre/cap. d
Igpm	=	Imperial gallon per minute	1 Igpm	=	0.0758 litre/s
ppm	=	parts per million	1 ppm	=	1 mg/dm^3 = 1 mg/litre
Igpad	=	Imp. gallon per acre per day	1 Igpad	=	1.1234 m^3/day km^2
USgpm	=	U. S. gallon per minute	1 USgpm	=	0.0631 litre/s
mile	=	statute mile	1 mile	=	1609.344 m
sq. mi.	=	square mile	1 sq. mi.	=	2.59 km^2
in.	=	inch	1 in.	=	25.4 mm
ft.	=	foot	1 ft.	=	0.3048 m
ac.	=	acre	1 ac.	=	4046.9 m^2
mm--km^2	=	millimeter on square kilometer	1 mm--km^2	=	1000 m^3
in--sq. mi.	=	inch on square mile	1 in.--s.m	=	65785.7 m^3
ac--ft	=	feet on acre	1 ac--ft	=	1233.5 m^3
1 mm--km^2/year	=	2.74 m^3/day = 0.114 m^3/hour = 0.0317 litre/sec			
	=	602.2 Igpd = 0.4182 Igpm = 0.0152 in--sm/year			
Igpm/ft	=	Imperial gallon per minute per foot (specific capacity -- transmissivity -- transmissibility)	1 Igpm/ft	=	0.2486 x 10^{-3} m^2/s
Igpd/sq. ft.	=	Imperial gallon per day per square feet of cross--section (Specific discharge -- conductivity -- permeability)	1 Igpd/sq.ft.	=	0.5663 x 10^{-6} m/s
				=	0.04893 m/day

TABLE (A.3)

ABBREVIATIONS USED IN TEXT

cm = centimetre

cu. m = cubic metre

Kg = Kilogram

Km = Kilometre

l/day = litres per day

l/s = litres per second

m = metre

mm = millimetre

m^2/day = square metres per day

m^3/s = cubic metres per second

mg/l = Milligram per litre

Mw = Megawatt

NTU = Nephelometric turbidity units

sq. Km = square Kilometre

^{o}c = Degrees centrigrade

APPENDIX B

GLOSSARY

- A -

area, catchment - see drainage area

area, drainage - see drainage area

aquiclude - a formation which, although porous and capable of absorbing water slowly, will not transmit it fast enough to furnish an appreciable supply for a well or spring, ref (10)

aquifer - a formation, group of formations, or part of a formation that is water bearing, ref (10)

axial length - the distance from the outlet of a drainage basin to the most remote point of that basin, ref (9)

- B -

bank protection - in a narrow sense, revetment or other armor stabilizing a bank against erosion; more generally, any means to accomplish the purpose, including devices deflecting the erosion forces away from the bank, ref (6)

bar - (1) a site in a channel of a watercourse where sand and gravel deposits have accumulated; (2) the deposits themselves, ref (9)

basement complex - a series of complex igneous and metamorphic rocks, overlain unconformably by sedimentary strata, ref (10)

basin area - area within the watershed; drainage basin; also the area of such a basin, ref (3)

basin perimeter - the perimeter of the area within the watershed, ref(9)

basin length - the distance from the outlet to the most remote point of the basin.

- C -

Cambrian - see geologic time scale

compactness coefficient - an indication of basin shape obtained by dividing the perimeter of the basin by the circumference of a circle of equal area to that of the basin; high values of a compactness coefficient indicate basins which are long and narrow, ref (9)

- D -

Devonian - see geologic time scale

discharge - the quantity of water, silt or other mobile substances passing along a conduit per unit of time; rate of flow, cubic feet per second, litres per second, millions of gallons per day, etc., ref (9)

divide - the ridges or regions of high ground that separate the drainage basins of streams, ref (11)

drainage area - (1) the area (square metres, acres, etc.) of a drainage basin; (2) catchment area, drainage basin, ref (3); (3) the area that is drained by a watercourse, ref (1), (9)

drainage pattern - the system of watercourses which provides drainage of an area, ref (9)

- E -

ecology - the (branch of biology) science dealing with the relation between living organisms and their environment; the relationship between and distribution of human groups relative to resources with consequential social and cultural patterns, ref (7)

environment - all of the surrounding conditions and influences that affect the development of a living thing, ref (7)

erosion - wearing away of land by physical and chemical action in moving water or air, ref (6)

erosion control work - construction to lessen erosion of the banks of the watercourse, ref (9)

estuary - tidal reach at the mouth of a river, ref (5)

extrusive rocks - igneous rocks formed when magma flows over the earth's surface, ref (11)

- F -

fecal coliforms - bacteria present in animal and human wastes; their presence indicating contamination of a water supply, ref (10)

fault - a fracture in a rock surface, along which there is displacement of broken surfaces, ref (11)

flood - (1) a relatively high flow as measured by either gauge height or discharge quantity. Also any flow equal to or greater than a designated basic flow; (2) to inundate or overflow, ref (8)

flood, annual - (1) the highest discharge in a water year; (2) the flood which was equalled or exceeded once each year on the average, ref (8) flood, computed maximum - the largest momentary flood discharge believed possible from a consideration of meteorologic conditions and snow cover within the watershed, ref (8)

flood damages - the costs associated with flooding, including indirect and intangible costs except where noted, ref (9)

flood damage reduction - see flood protection

flood plain - flat land bordering a watercourse and subject to flooding, ref (5)

flood protection - measures taken to protect lines, or property from risk of flood, ref (9)

fluvial - of or produced by the water flow of a watercourse, ref (9)

flow duration curve - graph of flow vs. the percentage of flows greater or less, ref (9)

form factor - an indication of the basin shape obtained by dividing the area of the basin by the square of the basin length.

- G -

gallery - a horizontal type of water installation used where the aquifer is thin or of low permeability, ref (10)

geologic time scale - a system for the recording of natural events over incredibility long periods of time; the longest division of time in the geologic timetable is the era which is subdivided into periods which are further divided into epochs, ref (11)

The eras are:
Cenozoic - Age of Mammals
Mesozoic - Age of Reptiles
Paleozoic - Age of Invertebrates, Fishes and Amphibians
Proterozoic)
Archeozoic) Precambrian
Azoic)

The Neogene is also called the Quaternary period and the Paleogene is also called the Tertiary period.

FIGURE B-1

GEOLOGIC TIME SCALE

Era	Period	Epoch	Duration In Millions Of Years	Millions Of Years Ago Started
Cenozoic	Neogene (Quaternary)	Recent	0.15	-
		Pleistocene	1.9	2
	Paleogene (Tertiary)	Pliocene Miocene Oligocene Eocene Paleocene	68	70
Mesozioc	Cretaceous		65	135
	Jurassic		45	180
	Triassic		45	225
Palezoic	Permian		45	270
	Pennsylvanian	Carboniferous	60	330
	Mississippian		20	350
	Devonian		50	400
	Silurian		40	440
	Ordovician		60	500
	Cambrian		100	600
Precambrian				

SOURCE: Simplified form, ref (11)

glaciofluvial deposits - those unconsolidated deposits emplaced by stream action originating from the melting of glaciers, ref (10)

glaciomarine - having to do with glacial deposits in a sea water environment, ref (10)

- H -

head pond - an impoundment of water of any size, behind a man-made dam, which has as its primarily function the providing of head for a prime mover, such as a turbine, ref (9)

high water - a water level which is higher than normal in lakes, rivers, and streams, ref (9)

hydraulic - pertaining to water in motion and the mechanics of that motion, ref (6)

hydraulic elements - the depth, area, perimeter, mean depth, hydraulic radius, velocity, energy and other quantities pertaining to a particular stage of flowing water, ref (1)

hydrograph - a graph of water discharge or water surface elevation on the ordinate versus time on the abscissa, ref (9)

hydrologic - pertaining to the cyclic phenomena of waters of the earth -- successively as precipitation, and quantities pertaining to a particular stage of flowing water, ref (1)

hydrometric station - a station for the direct or indirect measurement of stage or discharge; for criteria for establishing a hydrometric station are accessibility, adequacy, stability and permanency, ref (12)

- I -

ice marginal features - geological features created at the margins of a glacier, ref (10)

impervious - a term applied to a material through which water cannot pass or through which water passes with great difficulty; impermeable, ref (8)

indurated - rendered hard, ref (10)

interference - the lowering of a water level in a well as a result of pumping in a nearby well, ref (10)

intrusives, intrusive rocks - rocks formed when magma solidifies among other rocks below the earth's surface, ref (11)

inundation - an overflowing; flood, ref (1)

irrigation - the artificial application of water to lands for agricultural purposes, ref (3)

- J -

jam - accumulation of debris, ice or other material so as to become wedged in the channel of a watercourse, and forming a partial or complete obstruction, ref (9)

Jurassic - see geologic timetable

- L -

lava - liquid rock material that flows out on the surface of the earth from sources below, ref (11)

- M -

marsh - low land covered at times by water, ref (1)

marine - having to do with the sea, ref (10)

mass curve - a graph of the cumulative values of a hydrologic quantity, generally as ordinate, plotted against time or date as abscissa, ref (12)

metasediments - partly metamorphosed sedimentary rocks, ref (10)

Mississippian - see geologic timetable

- N -

navigable water - there is no definition of navigable water given in the Navigable Waters Protection Act, R. S. C. 1970 Chapter N-19. If requested the Federal Ministry of Transport will give its views as to whether a particular body of water is navigable. The Ministry of Transport takes no responsibility for having advised that in its opinion a water is not navigable is a court later holds that it is, or vice versa, ref M. O. T. publication

navigation - the movement of people or goods by water, ref (9)

- O -

Ordovician - see geologic time scale

- P -

Paleozoic - see geologic time scale

peneplane - the flat surface that remains after the wearing down of landforms by the agents of weathering and erosion, ref (1)

Pennsylvanian - see geologic time scale

Permian - see geologic time scale

physiography - the branch of geology that deals with the earth's surface resources, ref (11)

Precambrian - see geologic time scale

- Q -

Quaternary - see geologic time scale

- R -

recharge - downward infiltration of rainfall and snowmelt to the water table, ref (11)

recurrence interval - average period of years between observed or predicted occurences of a discharge or stage equalling or exceeding a stated value, ref (5)

- S -

safe yield - the rate at which water can be withdrawn from an aquifer without depleting the supply to such an extent that withdrawal at this rate is harmful to the aquifer, or to the quality of the water, or is no longer economically feasible, ref (10) salmonoid - of or related to the salmon family, which includes salmon and trout, ref (9)

salt water intrusion - moving inland of sea water as a result of too high a pumping rate of wells in coastal areas, ref (10)

Silurian - see geologic time scale

strata - rock layers or beds, ref (11)

surficial geology - the geology of unconsolidated materials at the land surface, ref (10)

syncline - the trough or downfold of a rock fold, ref (11)

synclinal - in the form of synclines, i.e. folded such that the beds dip inward from both sides toward the axis, ref (10)

- T -

till - non-sorted, nonstratified sediment carried or deposited by a glacier, ref (10)

topography - the physical features of a region, ref (11)

Triassic - see geologic time scale

- U -

unconsolidated deposits - loose geologic materials such as clay, sand, and gravel resting on top of bedrock, ref (10)

- W -

watercourse - the full width and length, including the beds, banks, sides and shoreline of any river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, or any part thereof, the primary function of which is conveyance or containment of water whether the flow be continuous or not; ref N. B. Clean Environment Act

watercourse alteration - any change made intentionally, at, near or to a watercourse or to water flow in a watercourse, both temporary and permanent and includes:
(i) any changes made to existing structures in the watercourse including repairs, modifications or removal, whether the water flow is altered or not;
(ii) the temporary or continuous operation of machinery on the bed of a watercourse other than at a recognized fording place;
(iii) any removal of sand, gravel, rock, topsoil or similar material from a watercourse or within thirty metres of the bank of a watercourse;
(iv) any removal of vegetation from the bed or bank of a watercourse; and
(v) any removal of trees within ten metres of the bank of a watercourse; ref N. B. Clean Environment Act

watershed - (1) a series of slopes that drain into a river system, ref (11); (2) the topographical divide which defines a drainage basin, ref (9)

water supply design curves - graphs on logarithmic paper of streamflow versus a period of time useful in the design of water supply systems, ref (9)

water table - the upper boundary of the groundwater, below which all spaces within the rock are completely filled with water, ref (11)

water quality standards - objectives and criteria regarding the acceptability of certain physical, chemical and biological parameters of water, as related to a particular use, ref (9)

wave cut terrace - a terrace cut as a result of wave action along a former shoreline, which has since been lifted up, ref (11)

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APPENDIX C

LISTS OF HYDROMETRIC AND WATER QUALITY STATIONS IN THE REGION

TABLE (C.1) HYDROMETRIC STATIONS IN THE MONCTON PLANNING REGION

Station Number	Station Name	Flow Regime	Drainage Area (sq. Km)	Length of Record (yrs.)	Extreme Daily Flow Maximum (cu.m/s)	Extreme Daily Flow Minimum (cu.m/s)
	Active Stations					
01BR001	Kouchibouguac River near Vautour	Nat.[1]	177	12	59.5	0.227
01BS001	Coal Branch River at Beersville	Nat.	166	16	67.4	0.065
01BU002	Petitcodiac River near Petitcodiac	Nat.	391	18	210.	0.102
01BU003	Turtle Creek at Turtle Creek	Nat.	129	17	76.7	0.224
01BU004	Palmers Creek near Dorchester	Nat.	34.2	13	27.9	0.014
01BV007	Upper Salmon River near Alma	Nat.	181	11	154	0.221E
01BV006	Point Wolfe River at Fundy National Park	Nat	130	16	118	0.108
01AN002	Salmon River at Castaway	Nat.	1050	6	289E	1.19E
01AN001	Castaway Brook near Castaway	Nat.	34.4	8	18.1	0.045
01AP002	Canaan River at East Canaan	Nat.	668	34	236	0.057

Nat. Natural Flow
E. Estimated

Source: Historical Streamflow Summary, Atlantic Provinces, 1979

TABLE (C.2) HYDROMETRIC STATIONS IN THE MONCTON PLANNING REGION

Station Number	Station Name	Flow Regime	Drainage Area (sq. Km)	Length of Record (yrs.)	Extreme Daily Flow	
					Maximum (cu.m/s)	Minimum (cu.m/s)
	Inactive Stations					
01BU001	Petitcodiac River near Salisbury	Nat.	746	2	-	-
01BV003	Upper Salmon River at Alma	Nat.	181	1	-	-
01BV002	Kinnie Brook at Fundy National Park	Nat.	6.48	2	-	-

TABLE (C.3) PROVINCIAL WATER QUALITY STATIONS ON RIVERS AND LAKES IN THE MONCTON PLANNING REGION

Station Number	Name of Watercourse	Year Established	Latitude °	Latitude '	Latitude "	Longitude °	Longitude '	Longitude "
00BR01BU0007	Petitcodiac River	1974	46	3	19.67	64	48	44.21
00BR01BU0008	Petitcodiac River	1974	46	3	55.33	64	48	26.17
00BR01BU0009	Petitcodiac River	1974	46	1	18.37	65	2	4.27
00BR01BU0010	Petitcodiac River	1974	45	59	51.36	65	5	31.24
00BR01BU0011	Petitcodiac River	1974	45	56	49.96	65	10	5.88
00BR01BU0012	Petitcodiac River	1974	45	56	18.38	65	11	55.64
00BR01BU0013	Petitcodiac River	1974	46	1	7.82	65	11	.13
00BR01BU0014	Petitcodiac River	1974	46	4	41.99	65	4	19.81
00BR01BU0015	Pollett River	1974	45	57	20.48	65	5	5.57
00BR01BU0016	Pollett River	1974	45	54	25.06	65	5	13.85
00BR01BU0017	Pollett River	1974	45	48	45.14	65	6	25.02
00BR01BU0018	Pollett River	1974	45	45	19.22	65	4	47.46
00BR01BU0019	CoverDale River	1974	46	1	10.99	65	1	23.56
00BR01BU0020	CoverDale River	1974	45	59	19.68	64	58	27.96
00BR01BU0021	CoverDale River	1974	45	57	26.17	64	57	18.43
00BR01BU0022	CoverDale River	1974	45	53	30.84	64	58	19.78
00BR01BU0023	CoverDale River	1974	45	50	41.03	64	58	54.85
00BR01BU0024	Turtle Creek	1974	46	2	41.78	64	52	46.67
00BR01BU0025	Turtle Creek	1974						
00BR01BU0026	Turtle Creek	1974						
00BR01BU0027	Jonathan Creek	1975	46	5	53.88	64	52	10.34
00BR01BU0028	Johathan Creek	1975	46	5	.31	64	48	55.76
00BR00BU0029	Halls Brook	1974	45	5	55.97	64	46	36.01
00BR01BU0030	Halls Brook	1974	46	6	17.24	64	47	44.70
00BR01BU0031	Halls Brook	1974	46	6	38.99	64	48	24.98
00BR01BU0032	Halls Brook	1974	46	7	16.86	64	49	48.25
00BR01BU0033	Halls Brook	1974	46	7	45.16	64	51	42.88

Source: Environmental Services Branch, N.B. Department of the Environment

TABLE (C.3) cont.

Station Number	Name of Watercourse	Year Established	Latitude			Longitude		
			°	'	"	°	'	"
00BR01BU0034	Humphreys Brook	1974	46	6	46.8	64	46	17.65
00BR01BU0035	Humphreys Brook	1974	46	7	34.61	64	44	42.22
00BR01BU0036	Fox Creek	1974	46	3	45.36	64	42	22.36
00BR00BS0001	Coal Branch River	1975	46	24	22.21	65	4	27.84
00BR00BS0002	Coal Branch River	1975	46	24	57.89	65	4	26.87
00BR00BS0003	Coal Branch River	1975	26	26	37.32	65	3	53.14
00BR01BS0004	Coal Branch River	1975	46	26	51.22	65	3	53.68
00BR01BS0005	Coal Branch River	1975	46	29	7.40	65	5	34.98
00BR01BS0016	Coal Branch River	1975	46	28	12.0	65	14	43.84
00BR01BS0018	Coal Branch River	1975	46	21	33.44	65	9	6.91
00BR01BS0019	Coal Branch River	1975	46	21	4.68	65	8	44.74
00BR01BS0020	Trout Creek	1975	46	25	37.38	65	12	33.30

TABLE (C.4) FEDERAL WATER QUALITY STATIONS ON RIVERS AND LAKES IN THE MONCTON PLANNING REGION

Station Number	Name of Watercourse	Period of Record	No. of Samples	Stations Location Latitude			Longitude		
				°	'	"	°	'	"
00NB01BS0018	Buctouche River @ Coates Mills	1975-77	8	46	22	16	64	52	34
00NB01BS0001	Coal Branch River @ Beersville	1969-74		46	26	35	65	3	55
00NB01BR0001	Kouchibouguac River @ Hwy. 11			46	47	32	65	3	16
00NB01BR0011	Kouchibouguac River @ Vautour	1975-77		46	44	40	65	12	20
00NB01BU0008	Memramcook River @ Calhoun	1970-73		46	4	0	64	34	20
00NB01BU0001	Palmers Creek near Dorchester	1970-77		45	53	15	64	31	0
00NB01BU0004	Petitcodiac River @ Causeway	1970-77		46	3	57	64	48	27
00NB01BU0005	Petitcodiac River @ Salisbury	1970-74		46	1	20	65	2	5
00NB01BU0031	Petitcodiac River near Petitcodiac	1972-73		45	56	37	65	10	13
00NB01BV0015	Point Wolf River @ Mouth	1972-77		45	33	2	65	0	49
00NB01BS0046	Richibucto River @ Hwy. 116	1975-77		46	31	23	67	29	30
00NB01AN0001	Salmon River @ Gaspereau Forks	1970-77		46	13	48	65	50	48
00NB01BU0006	Turtle Creek Reservoir	1965-77		45	57	34	64	52	41

SOURCE(S): (a) Environment Canada-1979: Water Quality Data New Brunswick. 1961-1977.
(b) Naquadat New Brunswick Interpretative Report Numeric Station List, February 1981.
(c) Naquadat Numeric Station List, Atlantic Region, N.B., Nfld., N.S., P.E.I., March, 1980.

Table (C.5) Snow Course Stations in the Moncton Planning Region

NAME	NUMBER	LATITUDE	LONGITUDE	ELEVATION METRES	PERIOD OF RECORD
Coal Branch	6546X2	46°26'	65°05'	61	1965-1983
Moncton	6446X1	46°04'	64°36'	45	1954-1983
Chatham Airport	6547XX	47°01'	65°26'	34	1965-1983
Point Wolfe-Upper	6545X2	45°37'	65°03'	366	1966-1983
Point Wolfe-Lower	6445XX	45°34'	65°00'	61	1966-1983
Turtle	6445X1	45°58'	64°53'	76	1963-1983
Castaway open	-	46°17'	65°43'	23	1982-1983
Castaway Forest	-	45°17'	65°43'	23	1982-1983
Sussex Open	6545XX	45°44'	65°28'	30	1982-1983
Sussex Forest	6545X1	45°44'	65°28'	30	1962-1983

Source: Environment Canada (AES) Snow Cover Data, Canada

APPENDIX D

FLOW DURATION CURVES OF HYDROMETRIC STATIONS IN THE REGION

Introduction:

Flow duration curves have been developed for selected hydrometric stations in the Moncton Planning Region. Data up to 1983 were used in this development. These flow duration curves are presented in this appendix.

These flow duration curves show the percentages of time that various rates of discharge have been equalled or exceeded. Streamflow characteristics such as dependability of low flows in times of drought and persistance in times of flood may be readily obtained from these curves.

The flow duration curve is a useful device for analyzing and predicting the variability of streamflow. Such a curve defines the frequency of occurrence of various rates of flow without regard to chronological sequence. Thus, a major disadvantage of this type of analysis is that it is not possible to tell whether the lowest flows occurred in consecutive periods or were scattered throughout the record.

However, flow duration curves have been widely used by engineers to solve problems related to water supply, power developments, sediment production, dilution and disposal of sewage and industrial wastes. The shape of the flow duration curve is indicative of the groundwater contribution to the stream, geologic structure, topography, soil type, vegetation, and other factors. It provides a convenient and appropriate means of relating the characteristics of different streams.

```
STATION :   01AN001     FLOW                    CASTAWAY BROOK NEAR CASTAWAY
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %, I.E.      0 DAYS.

 YEAR        MAX        MON DY         MIN         MON DY    TOT DAYS      MEAN         STD        MISSED
          FLOW,CMS                  FLOW,CMS                 DAY USED    FLOW,CMS    DEVIATION     MONTHS


 1972         9.71       5  5          0.10         4 12    366 366        0.94         1.24
 1973        10.80      12 22          0.10        10 30    365 365        1.11         1.13
 1974        18.10      12 10          0.13         1 21    365 365        0.93         1.41
 1975         7.82      11 14          0.12         9  2    365 365        0.73         0.95
 1976         9.12       4  3          0.15         6 24    366 366        0.99         1.15
 1977         8.64      10 21          0.09         8 31    365 365        1.06         1.39
 1978         6.46       4 22          0.04         8 20    365 365        0.67         1.06
 1979        12.50       3  9          0.11         7 25    365 365        1.41         1.93
 1980         9.77       4  5          0.05         3  5    366 366        0.90         1.03
 1981        10.50       4  6          0.08         9  8    365 365        1.04         1.23
 1982        10.60       4 18          0.10         7 19    304 283        0.94         1.25       8  9
 1983         5.96       6  1          0.06         9 16    365 365        0.68         0.82


      STATION 01AN001 COMPLETED.     12 YEARS PROCESSED.    427 RECORDS PROCESSED.
  RECORDS SKIPPED ; WRONG DATA:     0, WRONG SEQUENCE:     0, YEAR NOT WANTED:     0, MONTH NOT WANTED:     0
```

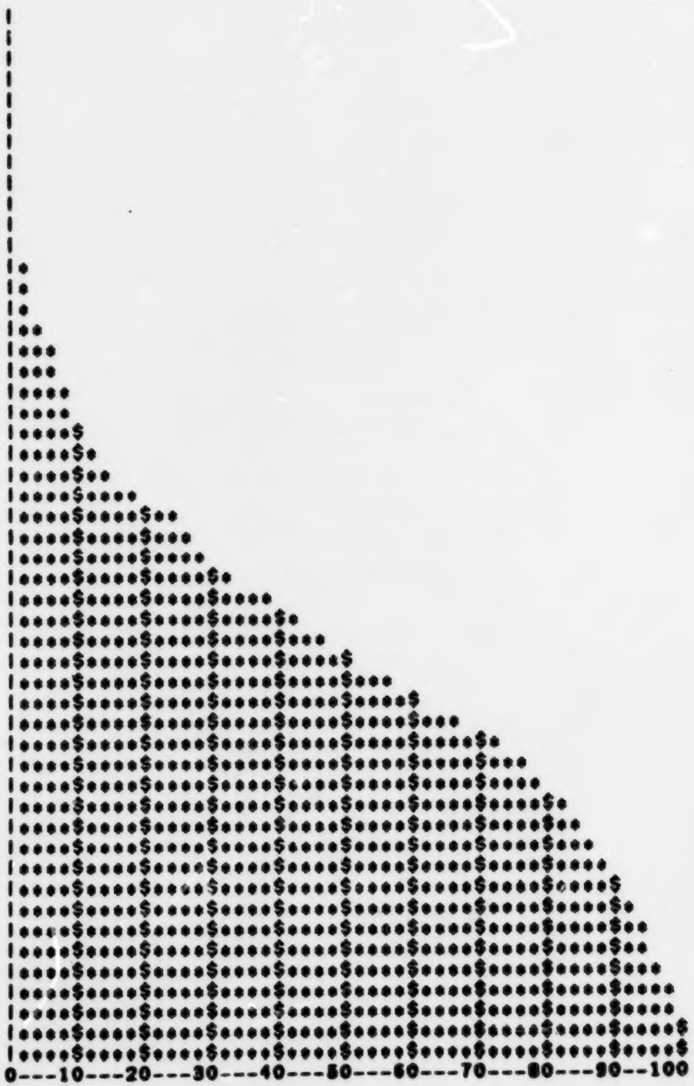
```
STATION :   01AN001    FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

   FLOW,CMS  %MAX-MIN %GREATER #GREATER        FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

      18.10   100.00     0.00        0 I
      17.92    99.00     0.02        1 I
      17.74    98.00     0.02        1 I
      17.20    95.00     0.02        1 I
      16.29    90.00     0.02        1 I
      15.39    85.00     0.02        1 I
      14.49    80.00     0.02        1 I
      13.59    75.00     0.02        1 I
      12.68    70.00     0.02        1 I
      11.78    65.00     0.05        2 I
      10.88    60.00     0.07        3 I
       9.98    55.00     0.14        6 I
       9.07    50.00     0.26       11 I
       8.17    45.00     0.51       22 I
       7.27    40.00     0.70       30 I
       6.36    35.00     1.14       49 I*
       5.46    30.00     1.53       66 I*
       5.01    27.50     1.95       84 I*
       4.56    25.00     2.46      106 I*
       4.11    22.50     3.02      130 I**
       3.66    20.00     3.81      164 I**
       3.20    17.50     5.14      221 I***
       2.75    15.00     7.00      301 I***
       2.30    12.50     9.21      396 I****$
       1.85    10.00    12.95      557 I****$*
       1.67     9.00    15.30      658 I****$***
       1.49     8.00    17.76      764 I****$****
       1.31     7.00    20.86      897 I****$****$
       1.13     6.00    24.39     1049 I****$****$**
       0.95     5.00    29.32     1261 I****$****$****$
       0.86     4.50    32.41     1394 I****$****$****$*
       0.77     4.00    36.11     1553 I****$****$****$***
       0.68     3.50    40.71     1751 I****$****$****$****$
       0.59     3.00    45.18     1943 I****$****$****$****$***
       0.50     2.50    51.66     2222 I****$****$****$****$****$*
       0.41     2.00    59.17     2545 I****$****$****$****$****$****$
       0.37     1.80    62.36     2682 I****$****$****$****$****$****$*
       0.33     1.60    65.89     2834 I****$****$****$****$****$****$***
       0.30     1.40    69.73     2999 I****$****$****$****$****$****$****$
       0.26     1.20    73.84     3176 I****$****$****$****$****$****$****$**
       0.23     1.00    78.73     3386 I****$****$****$****$****$****$****$****
       0.21     0.90    81.70     3514 I****$****$****$****$****$****$****$****$*
       0.19     0.80    84.77     3646 I****$****$****$****$****$****$****$****$**
       0.17     0.70    87.33     3756 I****$****$****$****$****$****$****$****$****
       0.15     0.60    89.47     3848 I****$****$****$****$****$****$****$****$****$
       0.14     0.50    92.42     3975 I****$****$****$****$****$****$****$****$****$*
       0.12     0.40    94.61     4069 I****$****$****$****$****$****$****$****$****$**
       0.10     0.30    96.28     4141 I****$****$****$****$****$****$****$****$****$***
       0.08     0.20    97.67     4201 I****$****$****$****$****$****$****$****$****$****
       0.06     0.10    99.00     4258 I****$****$****$****$****$****$****$****$****$****$
       0.04    -0.00   100.00     4301 I****$****$****$****$****$****$****$****$****$****$
                                       0---10---20---30---40---50---60---70---80---90--100
```

CASTAWAY BROOK NEAR
CASTAWAY

Drainage Area 34.4 km^2
Natural Flow

```
STATION :   01AM002     FLOW                              SALMON RIVER AT CASTAWAY
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

 YEAR          MAX       MON DY          MIN         MON DY      TOT DAYS      MEAN          STD          MISSED
            FLOW,CMS                  FLOW,CMS                   DAY USED    FLOW,CMS     DEVIATION       MONTHS


 1974        209.00     12 10           2.97        9  3       365 365       24.19         29.44
 1975        185.00      5  8           1.49        9  8       365 365       21.74         29.63
 1976        182.00      4  4           3.77        9 26       366 366       25.21         27.88
 1977        261.00      4 23           1.70        9  3       365 365       29.00         37.25
 1978        173.00      4 21           1.19        8 20       365 365       15.68         25.99
 1979        234.00      3  9           2.44        7 26       365 365       35.40         41.28
 1980        186.00      4  5           1.78        3  4       366 366       21.50         22.50
 1981        242.00      4  6           3.05        9  9       365 365       20.42         33.27
 1982        212.00      4 19           3.14        7 19       365 365       20.95         26.70
 1983        177.00      3 23           1.61        9 17       365 365       19.63         25.97


      STATION 01AM002 COMPLETED.    10 YEARS PROCESSED.   361 RECORDS PROCESSED.
 RECORDS SKIPPED ; WRONG DATA:    0, WRONG SEQUENCE:    0, YEAR NOT WANTED:    0, MONTH NOT WANTED:    0
```

```
STATION :    01AN002     FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %. I.E.      0 DAYS.

   FLOW,CMS  %MAX-MIN %GREATER #GREATER        FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

     289.00   100.00     0.00        0
     286.12    99.00     0.03        1
     283.24    98.00     0.03        1
     274.61    95.00     0.03        1
     260.22    90.00     0.05        2
     245.83    85.00     0.05        2
     231.44    80.00     0.11        4
     217.05    75.00     0.16        6
     202.66    70.00     0.33       12
     188.27    65.00     0.44       16
     173.88    60.00     0.58       21
     159.49    55.00     0.88       32
     145.09    50.00     1.29       47
     130.70    45.00     1.83       67
     116.31    40.00     2.55       93
     101.92    35.00     3.42      125
      87.53    30.00     5.01      183
      80.34    27.50     5.97      218
      73.14    25.00     7.48      273
      65.95    22.50     8.49      310
      58.75    20.00    10.21      373
      51.56    17.50    12.16      444
      44.36    15.00    14.76      539
      37.17    12.50    18.37      671
      29.97    10.00    23.25      849
      27.09     9.00    25.74      940
      24.21     8.00    28.78     1051
      21.34     7.00    32.72     1195
      18.46     6.00    37.05     1353
      15.58     5.00    42.96     1569
      14.14     4.50    46.30     1691
      12.70     4.00    50.19     1833
      11.26     3.50    55.26     2018
       9.82     3.00    60.19     2198
       8.39     2.50    66.32     2422
       6.95     2.00    72.65     2653
       6.37     1.80    75.49     2757
       5.79     1.60    78.53     2868
       5.22     1.40    81.41     2973
       4.64     1.20    83.93     3065
       4.07     1.00    86.88     3173
       3.78     0.90    88.50     3232
       3.49     0.80    90.25     3296
       3.20     0.70    91.87     3355
       2.92     0.60    93.07     3399
       2.63     0.50    94.61     3455
       2.34     0.40    95.87     3501
       2.05     0.30    97.10     3546
       1.77     0.20    98.27     3589
       1.48     0.10    99.48     3633
       1.19    -0.00   100.00     3652
```



SALMON RIVER AT CASTAWAY

Drainage Area 1,050 km^2
Natural Flow

```
STATION :    01AP002    FLOW                        CANAAN RIVER AT EAST CANAAN
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %. I.E.      0 DAYS.

 YEAR      MAX       MON DY       MIN       MON DY    TOT DAYS     MEAN        STD       MISSED
        FLOW,CMS              FLOW,CMS              DAY USED   FLOW,CMS   DEVIATION    MONTHS

 1925     72.20     10 29       3.11      12 31     92  69      16.31       14.12     1  2  3  4  5  6  7  8  9
 1926    161.00     10 26       0.06       8 21    365 365      15.34       30.92
 1927    127.00     10 20       0.96       2 25    365 365      16.00       18.17
 1928    120.00      4  8       0.54       7 13    366 366      11.18       15.74
 1929     92.90      4 18       0.25       8  8    365 365       9.68       13.40
 1930    110.00      1  9       0.25       9 13    365 365      12.26       17.93
 1931    141.00      4  1       0.54       2  3    365 365      10.96       18.73
 1932    124.00      4 17       0.54       9  1    366 366      12.09       22.04
 1933    199.00     10 25       0.25       7 26    365 365      17.62       29.07
 1934    190.00      4 14       0.28       9  7    365 365      11.82       26.53
 1935    120.00      1 12       0.42       9  8    365 365      16.23       22.81
 1936    118.00      3 14       0.56       8 11    366 366      13.77       18.35
 1937     59.70      4  9       0.34       8  5    365 365       7.93        8.37
 1938    114.00      4 18       0.76       7 22    365 365      14.88       16.73
 1939    198.00      4 23       0.28       8 29    365 365      11.02       20.03
 1940    139.00      9 17       0.60       9  6    366 366      14.29       22.64
 1941     25.50      3 29       2.18       2  7     90  90       6.33        4.86     4  5  6  7  8  9 10 11 12
 1962    115.00     11 23       3.74      10 20     92  92      16.39       15.33     1  2  3  4  5  6  7  8  9
 1963    204.00      5  2       0.91       7 18    365 365      15.74       26.93
 1964    209.00     12 27       0.31       8 17    366 366      10.92       24.71
 1965     78.60      4 18       0.16       8  7    365 365       6.87       10.48
 1966    104.00      3 26       0.21       9  1    365 365       9.47       13.61
 1967    184.00      5 13       0.80       8 26    365 365      14.54       22.11
 1968    116.00     11 14       0.26       9 21    366 366      12.52       18.65
 1969     98.00      4 18       0.31       7 11    365 365       9.01       14.91
 1970    122.00     10 25       0.33       1 29    365 365      11.68       12.77
 1971    183.00      4 15       0.26      10  2    365 365      14.67       25.83
 1972    235.00      5  5       1.36       2 11    366 366      15.70       25.03
 1973    195.00      7  6       1.10      10 30    365 365      15.08       18.29
 1974    188.00     12 10       0.50       8 28    365 365      14.30       19.00
 1975    131.00      5  7       0.36       9  3    365 365      13.08       20.50
 1976    106.00      4  4       0.39       6 24    366 366      14.01       17.71
 1977    178.00      4 23       0.36       9 10    365 365      17.13       24.09
 1978    148.00      4 22       0.27       9 29    365 365      10.85       19.89
 1979    170.00      1 30       0.84       7 26    365 365      20.60       25.85
 1980    102.00      4  6       0.35       3  4    366 366      13.45       15.07
 1981    184.00      4  6       0.81       9 13    365 365      19.71       25.81
 1982    182.00      4 18       0.55       7 20    365 365      13.08       18.28
 1983    116.00      3 23       0.80       9 16    365 365      12.19       15.76

       STATION 01AP002 COMPLETED.    39 YEARS PROCESSED.  1324 RECORDS PROCESSED.
RECORDS SKIPPED ; WRONG DATA:    0. WRONG SEQUENCE:    0. YEAR NOT WANTED:    0. MONTH NOT WANTED:    0
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STATION :    01AP002     FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

  FLOW,CMS  %MAX-MIN %GREATER #GREATER        FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

    236.00    100.00     0.00         0  I
    233.64     99.00     0.01         1  I
    231.28     98.00     0.01         1  I
    224.20     95.00     0.01         1  I
    212.41     90.00     0.01         1  I
    200.61     85.00     0.02         3  I
    188.81     80.00     0.07        10  I
    177.01     75.00     0.11        15  I
    165.22     70.00     0.13        18  I
    153.42     65.00     0.19        26  I
    141.62     60.00     0.26        35  I
    129.83     55.00     0.43        58  I
    118.03     50.00     0.72        96  I
    106.23     45.00     1.04       139  I*
     94.43     40.00     1.41       189  I*
     82.64     35.00     2.01       269  I*
     70.84     30.00     2.87       385  I*
     64.94     27.50     3.45       462  I**
     59.04     25.00     4.19       561  I**
     53.14     22.50     5.06       678  I***
     47.25     20.00     6.01       806  I***
     41.35     17.50     7.28       976  I****
     35.45     15.00     9.06      1214  I****$
     29.55     12.50    11.70      1568  I****$*
     23.65     10.00    15.87      2127  I****$***
     21.29      9.00    17.68      2369  I****$****
     18.93      8.00    20.07      2689  I****$****$
     16.57      7.00    22.78      3053  I****$****$*
     14.21      6.00    26.30      3524  I****$****$***
     11.85      5.00    31.25      4188  I****$****$****$*
     10.67      4.50    33.16      4443  I****$****$****$**
      9.49      4.00    36.11      4839  I****$****$****$***
      8.32      3.50    40.05      5367  I****$****$****$****$
      7.14      3.00    45.00      6030  I****$****$****$****$***
      5.96      2.50    50.34      6745  I****$****$****$****$****$
      4.78      2.00    57.10      7652  I****$****$****$****$****$****
      4.30      1.80    60.37      8089  I****$****$****$****$****$****$
      3.83      1.60    63.31      8484  I****$****$****$****$****$****$**
      3.36      1.40    67.06      8986  I****$****$****$****$****$****$****
      2.89      1.20    70.39      9432  I****$****$****$****$****$****$****$
      2.42      1.00    73.39      9834  I****$****$****$****$****$****$****$**
      2.18      0.90    76.20     10211  I****$****$****$****$****$****$****$***
      1.94      0.80    78.63     10536  I****$****$****$****$****$****$****$****
      1.71      0.70    80.06     10728  I****$****$****$****$****$****$****$****$
      1.47      0.60    82.82     11098  I****$****$****$****$****$****$****$****$*
      1.24      0.50    85.78     11494  I****$****$****$****$****$****$****$****$***
      1.00      0.40    87.37     11707  I****$****$****$****$****$****$****$****$****
      0.76      0.30    90.88     12178  I****$****$****$****$****$****$****$****$****$
      0.53      0.20    95.41     12785  I****$****$****$****$****$****$****$****$****$***
      0.29      0.10    98.63     13216  I****$****$****$****$****$****$****$****$****$****
      0.06     -0.00   100.00     13400  I****$****$****$****$****$****$****$****$****$****$
                                         0---10---20---30---40---50---60---70---80---90--100
```

CANAAN RIVER AT
EAST CANNAN

Drainage Area 668 km^2
Natural Flow

```
STATION :   01BR001     FLOW                          KOUCHIBOUGUAC RIVER NEAR VAUTOUR
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %, I.E.      0 DAYS.

YEAR       MAX      MON DY       MIN       MON DY    TOT DAYS      MEAN        STD       MISSED
        FLOW,CMS              FLOW,CMS               DAY USED    FLOW,CMS   DEVIATION    MONTHS

1930       3.51    12  2        0.43      11 17      61  50        1.17        0.60      1  2  3  4  5  6  7  8  9 10
1931      30.00     4  4        0.39       8 12     365 365        3.21        5.22
1932      43.00     4 17        0.29       9 14     366 366        3.09        5.39
1933       0.87     1  2        0.52       1  7      31   7        0.63        0.12      2  3  4  5  6  7  8  9 10 11 12
1969      28.30    12 12        0.94      10 20      92  92        3.90        4.29      1  2  3  4  5  6  7  8  9
1970      52.70     2  4        0.61       3 20     365 365        3.53        4.04
1971      41.60     4 15        0.34       9 27     365 365        3.92        7.04
1972      44.20     5  7        0.45       2 13     366 366        4.21        6.30
1973      27.50     4 19        0.49       9 17     365 365        3.90        4.50
1974      55.50    12 10        0.68       9  3     365 365        3.96        5.11
1975      56.60     5  8        0.37       9  8     365 365        3.82        6.74
1976      28.10     4  3        0.53       9 25     366 366        4.20        4.20
1977      59.50     4 23        0.33       9 13     365 365        5.23        7.32
1978      25.90     5 10        0.23       9  1     365 365        2.98        4.63
1979      35.90     4 11        0.54       7 27     365 365        4.99        5.79
1980      31.40     4 24        0.55       3  6     366 366        3.76        4.41
1981      54.00     4  6        0.66       2  1     365 365        5.33        6.24
1982      30.70     4 19        0.71       7 17     365 365        3.51        4.32
1983      25.80     5 31        0.35       8 25     365 365        3.23        4.01


     STATION 01BR001 COMPLETED,     19 YEARS PROCESSED,    595 RECORDS PROCESSED.
RECORDS SKIPPED ; WRONG DATA:    0, WRONG SEQUENCE:    0, YEAR NOT WANTED:    0, MONTH NOT WANTED:    0
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STATION :   01BR001     FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %, I.E.      0 DAYS.

   FLOW,CMS  %MAX-MIN %GREATER #GREATER        FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

      59.50    100.00     0.00        0  |
      58.91     99.00     0.02        1  |
      58.31     98.00     0.02        1  |
      56.54     95.00     0.03        2  |
      53.57     90.00     0.08        5  |
      50.61     85.00     0.10        6  |
      47.65     80.00     0.10        6  |
      44.68     75.00     0.13        8  |
      41.72     70.00     0.22       13  |
      38.75     65.00     0.28       17  |
      35.79     60.00     0.33       20  |
      32.83     55.00     0.43       26  |
      29.86     50.00     0.70       42  |
      26.90     45.00     1.05       63  |*
      23.94     40.00     1.59       95  |*
      20.97     35.00     2.35      141  |*
      18.01     30.00     3.27      196  |**
      16.53     27.50     4.14      248  |**
      15.05     25.00     4.97      298  |**
      13.56     22.50     5.86      351  |***
      12.08     20.00     6.96      417  |***
      10.60     17.50     8.61      516  |****
       9.12     15.00    10.46      627  |****$
       7.64     12.50    13.27      795  |****$**
       6.15     10.00    17.22     1032  |****$****
       5.56      9.00    19.24     1153  |****$****$
       4.97      8.00    21.22     1272  |****$****$*
       4.38      7.00    24.43     1464  |****$****$**
       3.78      6.00    28.42     1703  |****$****$****
       3.19      5.00    33.09     1983  |****$****$****$**
       2.89      4.50    36.19     2169  |****$****$****$***
       2.60      4.00    39.61     2374  |****$****$****$****$
       2.30      3.50    43.62     2614  |****$****$****$****$**
       2.01      3.00    48.66     2916  |****$****$****$****$****
       1.71      2.50    54.70     3278  |****$****$****$****$****$**
       1.41      2.00    62.12     3723  |****$****$****$****$****$****$*
       1.29      1.80    65.74     3940  |****$****$****$****$****$****$***
       1.18      1.60    69.00     4135  |****$****$****$****$****$****$****
       1.06      1.40    72.63     4353  |****$****$****$****$****$****$****$*
       0.94      1.20    76.76     4600  |****$****$****$****$****$****$****$***
       0.82      1.00    81.29     4872  |****$****$****$****$****$****$****$****$*
       0.76      0.90    83.76     5020  |****$****$****$****$****$****$****$****$**
       0.70      0.80    86.08     5159  |****$****$****$****$****$****$****$****$***
       0.64      0.70    88.52     5305  |****$****$****$****$****$****$****$****$****
       0.58      0.60    90.87     5446  |****$****$****$****$****$****$****$****$****$
       0.52      0.50    93.46     5601  |****$****$****$****$****$****$****$****$****$**
       0.46      0.40    95.59     5729  |****$****$****$****$****$****$****$****$****$***
       0.40      0.30    97.66     5853  |****$****$****$****$****$****$****$****$****$****
       0.35      0.20    98.92     5928  |****$****$****$****$****$****$****$****$****$****
       0.29      0.10    99.73     5977  |****$****$****$****$****$****$****$****$****$****$
       0.23     -0.00   100.00     5993  |****$****$****$****$****$****$****$****$****$****$
                                         0---10---20---30---40---50---60---70---80---90--100
```

KOUCHIBOUGUAC RIVER
NEAR VAUTOUR

Drainage Area 177 km^2
Natural Flow

```
STATION :   01BS001     FLOW                            COAL BRANCH RIVER AT BEERSVILLE
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %. I.E.      0 DAYS.

 YEAR       MAX        MON DY        MIN         MON DY     TOT DAYS       MEAN          STD        MISSED
          FLOW,CMS                 FLOW,CMS                 DAY USED     FLOW,CMS     DEVIATION     MONTHS

 1964       47.60      12 27         0.09          9 17     122 122         2.05          4.85      1  2  3  4  5  6  7  8
 1965       18.10       4 18         0.06          9 19     365 365         2.24          3.03
 1966       23.60       4 22         0.08          9  1     365 365         2.80          3.81
 1967       60.00       5 13         0.23          8 26     365 365         3.80          7.07
 1968       33.70      11 13         0.12          9 20     366 366         3.57          5.31
 1969       37.10       4 17         0.14          9  5     365 365         2.75          4.42
 1970       34.30       2  4         0.29          2  1     365 365         3.36          3.64
 1971       44.70       4 15         0.15         10  2     365 365         3.95          7.29
 1972       50.10       5  5         0.27          9 24     366 366         4.31          7.13
 1973       63.10       7  6         0.28         10 29     365 365         3.99          5.39
 1974       50.10      12 10         0.32          2 19     365 365         3.77          5.23
 1975       68.00       5  7         0.19          9  2     365 365         3.93          7.46
 1976       37.10       4  3         0.42          6 24     366 366         3.60          4.65
 1977       67.40       4 23         0.18          9 13     365 365         5.31          8.03
 1978       38.20       4 22         0.16          8 20     365 365         2.85          5.03
 1979       87.00       3 26         0.29          7 16     365 365         5.06          6.05
 1980       34.30       4  5         0.20          3  4     366 366         3.75          4.91
 1981       61.40       4  6         0.44          9 19     365 365         5.71          7.55
 1982       54.60       4 18         0.37          7 18     365 365         3.91          5.75
 1983       33.80       3 23         0.19          9 17     365 365         3.07          4.52

       STATION 01BS001 COMPLETED.    20 YEARS PROCESSED.   597 RECORDS PROCESSED.
 RECORDS SKIPPED : WRONG DATA:     0, WRONG SEQUENCE:     0, YEAR NOT WANTED:     0, MONTH NOT WANTED:     0
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STATION :    01BS001     FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %, I.E.      0 DAYS.

   FLOW,CMS  %MAX-MIN %GREATER #GREATER        FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

      67.40   100.00     0.00        0  |
      66.73    99.00     0.01        1  |
      66.05    98.00     0.01        1  |
      64.03    95.00     0.03        2  |
      60.67    90.00     0.06        4  |
      57.30    85.00     0.07        5  |
      53.93    80.00     0.10        7  |
      50.57    75.00     0.11        8  |
      47.20    70.00     0.18       13  |
      43.83    65.00     0.23       16  |
      40.47    60.00     0.27       19  |
      37.10    55.00     0.37       26  |
      33.73    50.00     0.67       47  |
      30.37    45.00     0.88       62  |
      27.00    40.00     1.26       89  |*
      23.63    35.00     1.81      128  |*
      20.27    30.00     2.63      186  |*
      18.58    27.50     3.24      229  |**
      16.90    25.00     3.97      280  |**
      15.22    22.50     4.84      342  |**
      13.53    20.00     6.05      427  |***
      11.85    17.50     7.41      523  |****
      10.17    15.00     9.06      640  |****$
       8.48    12.50    11.56      816  |****$*
       6.80    10.00    15.14     1069  |****$***
       6.13     9.00    16.80     1186  |****$***
       5.46     8.00    19.06     1346  |****$****$
       4.78     7.00    21.95     1550  |****$****$*
       4.11     6.00    25.07     1770  |****$****$***
       3.43     5.00    29.05     2051  |****$****$****$
       3.10     4.50    31.62     2233  |****$****$****$*
       2.76     4.00    34.80     2457  |****$****$****$**
       2.42     3.50    38.46     2716  |****$****$****$****
       2.09     3.00    42.84     3025  |****$****$****$****$*
       1.75     2.50    48.11     3397  |****$****$****$****$****
       1.41     2.00    55.01     3884  |****$****$****$****$****$***
       1.28     1.80    57.95     4092  |****$****$****$****$****$****
       1.14     1.60    61.56     4347  |****$****$****$****$****$****$*
       1.01     1.40    65.60     4632  |****$****$****$****$****$****$***
       0.87     1.20    69.55     4911  |****$****$****$****$****$****$****$
       0.74     1.00    73.97     5223  |****$****$****$****$****$****$****$**
       0.67     0.90    76.45     5398  |****$****$****$****$****$****$****$***
       0.60     0.80    79.00     5578  |****$****$****$****$****$****$****$****
       0.54     0.70    81.73     5771  |****$****$****$****$****$****$****$****$*
       0.47     0.60    84.90     5995  |****$****$****$****$****$****$****$****$**
       0.40     0.50    87.34     6167  |****$****$****$****$****$****$****$****$****
       0.33     0.40    90.27     6374  |****$****$****$****$****$****$****$****$****$
       0.27     0.30    93.39     6594  |****$****$****$****$****$****$****$****$****$**
       0.20     0.20    96.09     6785  |****$****$****$****$****$****$****$****$****$***
       0.13     0.10    99.09     6997  |****$****$****$****$****$****$****$****$****$****$
       0.06    -0.00   100.00     7061  |****$****$****$****$****$****$****$****$****$****$
                                        0---10---20---30---40---50---60---70---80---90--100
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COAL BRANCH RIVER
AT BEERSVILLE

Drainage Area 166 km^2
Natural Flow

```
STATION :   01BU002    FLOW                     PETITCODIAC RIVER NEAR PETITCODIAC
MONTHS SELECTED :   ALL MONTHS.
YEARS SELECTED :    ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %. I.E.      0 DAYS.

 YEAR       MAX       MON DY        MIN        MON DY      TOT DAYS       MEAN         STD        MISSED
         FLOW,CMS                FLOW,CMS                  DAY USED    FLOW,CMS    DEVIATION    MONTHS

 1961       38.50     11 28         0.35        9 13      122 117         5.43         6.70     1  2  3  4  5  6  7  8
 1962      210.00      4  2         0.83        3  1      365 365         9.24        16.43
 1963      125.00      5  2         0.80        8 12      365 365         9.80        15.71
 1964      114.00      4 16         0.31        8 17      366 366         6.52        14.03
 1965       30.00      4 18         0.18        8  6      365 365         4.08         5.60
 1966       56.90      3 25         0.10        8 23      365 365         5.13         7.35
 1967      136.00      5 13         0.45        9 23      365 365         9.49        15.81
 1968      106.00     11 14         0.28        9 19      366 366         8.12        13.78
 1969       65.10      4 11         0.33        9  5      365 365         5.82         9.28
 1970       75.60     10 25         0.43        8  1      365 365         5.72         7.65
 1971       88.90      4 15         0.30       10  4      365 365         7.89        12.78
 1972      106.00      5  5         0.59        9 25      366 366         9.49        14.05
 1973       86.90      7  6         0.63       10 17      365 365         9.24        10.83
 1974       91.50     12 10         0.36        8 23      365 365         8.46        10.99
 1975      101.00      4 20         0.25        9  2      365 365         8.17        14.08
 1976      119.00      1 29         0.66        7 11      366 366         9.73        15.38
 1977       78.70      4 23         0.48        9  2      365 365        10.36        12.97
 1978       75.90      4 22         0.23        8 26      365 365         6.34        11.21
 1979      113.00      1 30         0.63        7 14      365 365        13.62        18.10
 1980       63.70      4  4         0.48        3  4      366 366         7.74         9.32
 1981       91.90     10 29         0.81        8 15      365 365        11.71        15.94
 1982       80.00      4 18         0.62        7 16      365 365         8.00        10.00
 1983       83.60     12 15         0.68       10  4      365 366         7.19         9.81


      STATION 01BU002 COMPLETED,    23 YEARS PROCESSED,   805 RECORDS PROCESSED.
 RECORDS SKIPPED ; WRONG DATA:     0, WRONG SEQUENCE:     0, YEAR NOT WANTED:     0, MONTH NOT WANTED:    0
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STATION :   01BU002    FLOW
MONTHS SELECTED :   ALL MONTHS.
YEARS SELECTED :    ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %. I.E.      0 DAYS.

   FLOW,CMS  %MAX-MIN %GREATER #GREATER        FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

    210.00   100.00     0.00        0 |
    207.90    99.00     0.01        1 |
    205.80    98.00     0.01        1 |
    199.51    95.00     0.01        1 |
    189.01    90.00     0.01        1 |
    178.52    85.00     0.01        1 |
    168.02    80.00     0.01        1 |
    157.53    75.00     0.01        1 |
    147.03    70.00     0.01        1 |
    136.54    65.00     0.01        1 |
    126.04    60.00     0.04        3 |
    115.55    55.00     0.06        5 |
    105.05    50.00     0.16       13 |
     94.56    45.00     0.23       19 |
     84.06    40.00     0.39       32 |
     73.57    35.00     0.71       58 |
     63.07    30.00     1.17       95 |*
     57.82    27.50     1.48      121 |*
     52.58    25.00     1.84      150 |*
     47.33    22.50     2.32      189 |*
     42.08    20.00     3.07      250 |**
     36.83    17.50     4.10      334 |**
     31.59    15.00     5.41      441 |***
     26.34    12.50     6.98      569 |***
     21.09    10.00     9.30      758 |****$
     18.99     9.00    10.72      874 |****$
     16.89     8.00    12.57     1025 |****$*
     14.79     7.00    14.62     1192 |****$**
     12.70     6.00    17.32     1412 |****$****
     10.60     5.00    20.72     1689 |****$****$
      9.55     4.50    23.10     1883 |****$****$**
      8.50     4.00    26.05     2124 |****$****$***
      7.45     3.50    29.74     2424 |****$****$****$
      6.40     3.00    34.58     2819 |****$****$****$**
      5.35     2.50    39.55     3224 |****$****$****$****$
      4.30     2.00    46.06     3755 |****$****$****$****$***
      3.88     1.80    48.86     3983 |****$****$****$****$****
      3.46     1.60    52.22     4257 |****$****$****$****$****$*
      3.04     1.40    56.19     4581 |****$****$****$****$****$***
      2.62     1.20    61.18     4987 |****$****$****$****$****$****$*
      2.20     1.00    66.51     5422 |****$****$****$****$****$****$***
      1.99     0.90    69.15     5637 |****$****$****$****$****$****$****$
      1.78     0.80    72.42     5904 |****$****$****$****$****$****$****$*
      1.57     0.70    75.64     6166 |****$****$****$****$****$****$****$***
      1.36     0.60    78.84     6427 |****$****$****$****$****$****$****$****
      1.15     0.50    82.27     6707 |****$****$****$****$****$****$****$****$*
      0.94     0.40    85.73     6989 |****$****$****$****$****$****$****$****$***
      0.73     0.30    90.14     7348 |****$****$****$****$****$****$****$****$****$
      0.52     0.20    93.95     7659 |****$****$****$****$****$****$****$****$****$**
      0.31     0.10    98.38     8020 |****$****$****$****$****$****$****$****$****$****
      0.10    -0.00   100.00     8152 |****$****$****$****$****$****$****$****$****$****$
                                      0---10---20---30---40---50---60---70---80---90--100
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PETITCODIAC RIVER
NEAR PETITCODIAC

Drainage Area   391 km^2
Natural Flow

```
STATION :   01BU003    FLOW                        TURTLE CREEK AT TURTLE CREEK
MONTHS SELECTED :   ALL MONTHS.
YEARS SELECTED :    ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

 YEAR        MAX       MON DY        MIN        MON DY    TOT DAYS      MEAN          STD        MISSED
          FLOW,CMS               FLOW,CMS                 DAY USED    FLOW,CMS     DEVIATION     MONTHS


 1962       30.60     11 23          0.58         9 24    122 122        4.35          4.44      1  2  3  4  5  6  7  8
 1963       76.70     11  9          0.29         7 18    365 365        4.97          9.10
 1964       73.90     12 27          0.31         9 22    366 366        2.80          6.28
 1965       13.80      4 17          0.25         9 29    365 365        1.80          2.42
 1966       19.60      4 22          0.30         8 23    365 365        2.39          3.14
 1967       42.20      5 13          0.28         8 26    365 365        4.28          5.37
 1968       30.60      3 24          0.22         9 20    366 366        3.84          5.23
 1969       58.30     12 23          0.50         7 11    365 365        3.75          5.57
 1970       59.20      2  4          0.43         9  3    365 365        3.23          4.63
 1971       37.40      5  4          0.28        10  9    365 365        3.83          5.94
 1972       47.90     11 10          0.40         9 24    366 366        5.04          6.98
 1973       26.50      5 22          0.50        10 25    365 365        3.78          3.60
 1974       41.60     12  9          0.32         9 21    365 365        3.27          4.21
 1975       48.70     12 11          0.38         9  1    365 365        4.20          7.08
 1976       28.30      2  2          0.52         8 27    366 366        3.85          4.42
 1977       41.30      4 23          0.34         9  2    365 365        4.47          5.11
 1978       22.60      4 22          0.23        12 16    365 365        2.55          3.73
 1979       37.10      4 10          0.43         8  6    365 365        5.11          5.78
 1980       33.10     12  4          0.40         9  5    366 366        3.17          3.98
 1981       46.70      4  6          0.34         9 19    365 365        5.12          6.24
 1982       45.20      4 18          0.50         9 20    365 365        3.31          5.09
 1983       34.10     12 14          0.40        10  4    365 365        3.54          4.56


      STATION 01BU003 COMPLETED.    22 YEARS PROCESSED.   769 RECORDS PROCESSED.
 RECORDS SKIPPED ; WRONG DATA:    0, WRONG SEQUENCE:    0, YEAR NOT WANTED:    0, MONTH NOT WANTED:    0
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STATION :   01BU003    FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

  FLOW,CMS  %MAX-MIN %GREATER #GREATER       FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

    76.70   100.00    0.00       0  |
    75.94    99.00    0.01       1  |
    75.17    98.00    0.01       1  |
    72.88    95.00    0.03       2  |
    69.05    90.00    0.03       2  |
    65.23    85.00    0.04       3  |
    61.40    80.00    0.04       3  |
    57.58    75.00    0.06       5  |
    53.76    70.00    0.09       7  |
    49.93    65.00    0.10       8  |
    46.11    60.00    0.17      13  |
    42.29    55.00    0.22      17  |
    38.46    50.00    0.33      26  |
    34.64    45.00    0.49      38  |
    30.81    40.00    0.72      56  |
    26.99    35.00    1.05      82  |*
    23.17    30.00    1.50     117  |*
    21.25    27.50    1.91     149  |*
    19.34    25.00    2.41     188  |*
    17.43    22.50    3.16     246  |**
    15.52    20.00    3.90     304  |**
    13.61    17.50    4.99     389  |**
    11.70    15.00    6.57     512  |***
     9.78    12.50    8.61     671  |****
     7.87    10.00   11.69     911  |****$*
     7.11     9.00   13.51    1053  |****$**
     6.34     8.00   15.93    1241  |****$***
     5.58     7.00   19.03    1483  |****$****$
     4.81     6.00   21.98    1713  |****$****$*
     4.05     5.00   26.33    2052  |****$****$***
     3.67     4.50   28.82    2246  |****$****$****
     3.28     4.00   31.75    2474  |****$****$****$*
     2.90     3.50   35.13    2737  |****$****$****$***
     2.52     3.00   39.85    3105  |****$****$****$****$
     2.14     2.50   44.96    3503  |****$****$****$****$**
     1.75     2.00   51.73    4031  |****$****$****$****$****$*
     1.60     1.80   54.62    4256  |****$****$****$****$****$**
     1.45     1.60   57.83    4506  |****$****$****$****$****$****
     1.29     1.40   61.29    4776  |****$****$****$****$****$****$*
     1.14     1.20   65.40    5096  |****$****$****$****$****$****$***
     0.99     1.00   70.33    5480  |****$****$****$****$****$****$****$
     0.91     0.90   72.70    5665  |****$****$****$****$****$****$****$*
     0.84     0.80   75.40    5875  |****$****$****$****$****$****$****$***
     0.76     0.70   78.25    6097  |****$****$****$****$****$****$****$****
     0.68     0.60   81.33    6337  |****$****$****$****$****$****$****$****$*
     0.61     0.50   84.74    6603  |****$****$****$****$****$****$****$****$**
     0.53     0.40   88.36    6885  |****$****$****$****$****$****$****$****$****
     0.45     0.30   91.65    7141  |****$****$****$****$****$****$****$****$****$*
     0.38     0.20   95.50    7441  |****$****$****$****$****$****$****$****$****$***
     0.30     0.10   98.16    7649  |****$****$****$****$****$****$****$****$****$****
     0.22    -0.00  100.00    7792  |****$****$****$****$****$****$****$****$****$****$
                                    0---10---20---30---40---50---60---70---80---90--100
```

TURTLE CREEK AT
TURTLE CREEK

Drainage Area 129 km^2
Natural Flow

```
STATION :   01BU004     FLOW                    PALMERS CREEK NEAR DORCHESTER
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %, I.E.      0 DAYS.

 YEAR        MAX      MON DY       MIN        MON DY    TOT DAYS      MEAN          STD          MISSED
          FLOW,CMS              FLOW,CMS                DAY USED    FLOW,CMS     DEVIATION      MONTHS


 1966         2.51    12 30        0.03        7 12     184 155        0.43          0.39     1  2  3  4  8  9
 1967        17.60     5 13        0.06        8 26     365 365        1.04          1.87
 1968        12.60     3 20        0.01        9 22     366 366        0.94          1.76
 1969        21.00    12 23        0.04        9  4     365 365        0.71          1.27
 1970         8.81    10 17        0.03        3  5     365 365        0.74          1.03
 1971        20.20     2 14        0.04       10  1     365 365        1.06          1.92
 1972        22.60    11 10        0.01        9 25     366 366        1.23          2.26
 1973         4.62     8  5        0.04       10 10     365 365        0.82          0.85
 1974         9.68    11 26        0.04        8 13     365 365        0.83          1.08
 1975        27.90    11 14        0.03        9  1     365 365        0.98          1.94
 1976        13.70     7 13        0.08        7 11     366 366        0.97          1.37
 1977        11.80    12 26        0.07        8 10     365 365        1.23          1.59
 1978        10.50     4 21        0.02        9  6     365 365        0.69          1.09
 1979        13.00     4 10        0.13        7 16     365 365        1.41          1.74
 1980         7.60    12  4        0.05        2 16     366 366        0.70          0.99
 1981        10.00     2 12        0.04        9 19     365 365        1.08          1.28
 1982         7.89     4 18        0.07        7 19     365 365        0.75          0.97
 1983        12.20    12 14        0.07        7 20     365 365        0.86          1.32


      STATION 01BU004 COMPLETED,     18 YEARS PROCESSED,    631 RECORDS PROCESSED.
  RECORDS SKIPPED ; WRONG DATA:     0, WRONG SEQUENCE:     0, YEAR NOT WANTED:     0, MONTH NOT WANTED:     0
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STATION :   01BU004    FLOW
MONTHS SELECTED :   ALL MONTHS.
YEARS SELECTED :    ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.     0 DAYS.

  FLOW,CMS  %MAX-MIN %GREATER #GREATER

    27.90    100.00     0.00       0
    27.62     99.00     0.02       1
    27.34     98.00     0.02       1
    26.51     95.00     0.02       1
    25.11     90.00     0.02       1
    23.72     85.00     0.02       1
    22.32     80.00     0.03       2
    20.93     75.00     0.05       3
    19.53     70.00     0.06       4
    18.14     65.00     0.09       6
    16.75     60.00     0.13       8
    15.35     55.00     0.15      10
    13.96     50.00     0.16      10
    12.56     45.00     0.20      13
    11.17     40.00     0.33      21
     9.77     35.00     0.41      26
     8.38     30.00     0.64      41
     7.68     27.50     0.83      53
     6.99     25.00     1.01      64
     6.29     22.50     1.34      85
     5.59     20.00     1.70     108
     4.89     17.50     2.17     138
     4.20     15.00     3.05     194
     3.50     12.50     4.34     276
     2.80     10.00     6.57     418
     2.52      9.00     7.81     497
     2.24      8.00     9.49     604
     1.97      7.00    11.49     731
     1.69      6.00    14.41     917
     1.41      5.00    18.27    1163
     1.27      4.50    20.60    1311
     1.13      4.00    23.46    1493
     0.99      3.50    27.18    1730
     0.85      3.00    31.69    2017
     0.71      2.50    36.93    2350
     0.57      2.00    43.98    2799
     0.52      1.80    47.30    3010
     0.46      1.60    50.58    3219
     0.40      1.40    54.12    3444
     0.35      1.20    58.23    3706
     0.29      1.00    63.07    4014
     0.26      0.90    66.17    4211
     0.24      0.80    69.59    4429
     0.21      0.70    73.46    4675
     0.18      0.60    76.82    4889
     0.15      0.50    81.60    5193
     0.13      0.40    86.03    5475
     0.10      0.30    90.01    5726
     0.07      0.20    93.48    5949
     0.04      0.10    98.04    6239
     0.01     -0.00   100.00    6364
```
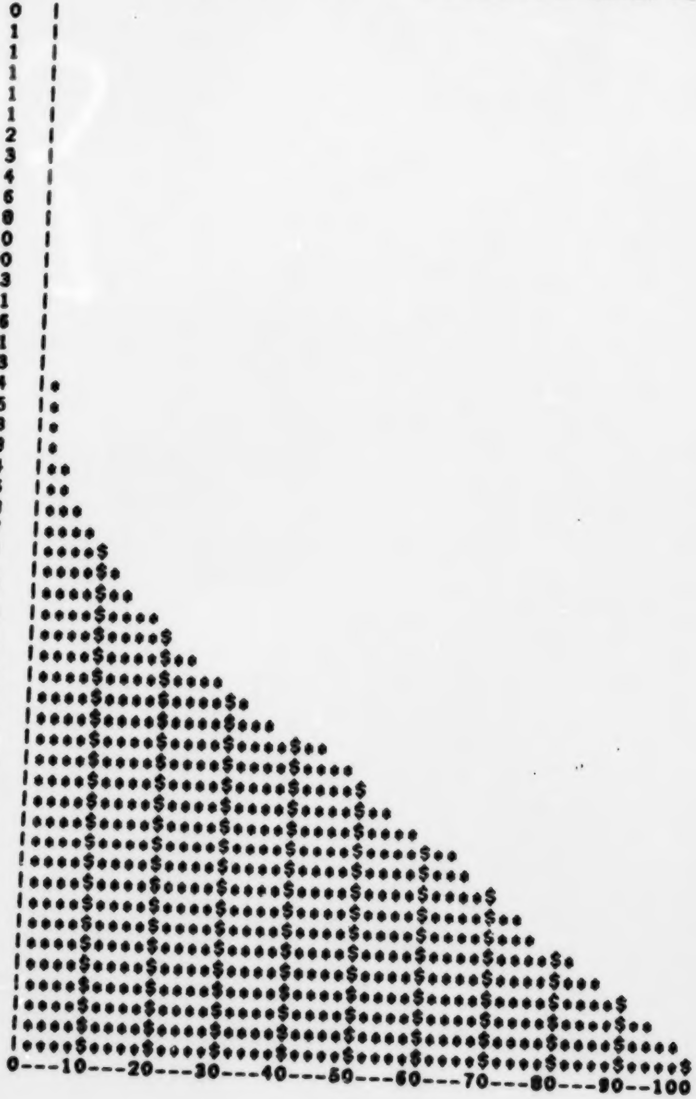

FLOW,CMS. VS. % GREATER THAN GIVEN FLOW

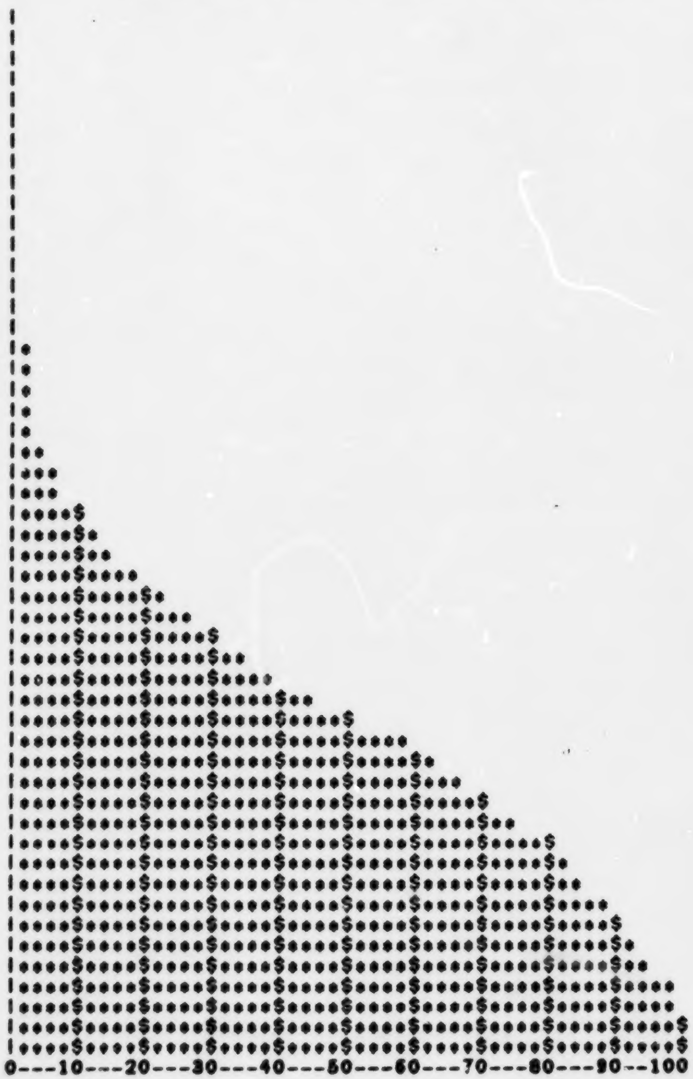


PALMERS CREEK NEAR
DORCHESTER

Drainage Area 34.2 km^2
Natural Flow

```
STATION :   01BV006    FLOW                        POINT WOLFE RIVER AT FUNDY NATIONAL PARK
MONTHS SELECTED :   ALL MONTHS.
YEARS SELECTED :    ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

 YEAR      MAX       MON DY      MIN      MON DY    TOT DAYS      MEAN        STD       MISSED
        FLOW,CMS              FLOW,CMS              DAY USED   FLOW,CMS   DEVIATION    MONTHS

 1964     72.20     12 27       0.37      7 18     275 265        4.81        7.58     1  2  3
 1965     95.80     12 27       0.11      8  6     365 365        3.05        6.49
 1966     30.30     11  4       0.27      8 29     365 365        3.99        3.69
 1967     44.70      9 30       0.60      3  9     365 365        6.26        7.37
 1968     35.40     12 16       0.25      8 24     366 366        4.27        5.08
 1969     71.10     12 23       0.65      7 11     365 365        5.30        6.56
 1970     62.60      2  4       0.54      1 31     365 365        4.94        5.06
 1971     54.90     10 11       0.32      7 13     365 365        4.62        6.35
 1972    118.00      5 16       0.89      8 27     366 366        6.07       10.17
 1973     53.80     12 22       0.38     10 25     365 365        6.26        7.06
 1974     40.20     12  9       0.40      8 17     365 365        4.96        4.98
 1975    117.00     11 14       0.33      9  2     365 365        5.71       10.27
 1976     64.30      7 13       0.33      7  8     366 366        6.36        7.30
 1977     55.10     10  2       0.71      1 23     365 365        6.24        6.89
 1978     69.10      5 10       0.13      9  5     365 365        4.32        6.68
 1979     72.80      4 10       0.83      2 24     365 365        7.87        9.00
 1980     64.60      4  5       0.35      3  2     366 366        4.71        7.08
 1981     78.00     10 28       0.39      9 19     365 365        7.82       11.10
 1982     35.00      4 30       0.63      3  4     365 365        4.52        5.02
 1983     40.00      3 22       0.40      7 20     365 365        5.08        5.92


     STATION 01BV006 COMPLETED.    20 YEARS PROCESSED.   712 RECORDS PROCESSED.
RECORDS SKIPPED : WRONG DATA:    0, WRONG SEQUENCE:    0, YEAR NOT WANTED:    0, MONTH NOT WANTED:    0
```

```
STATION :   01BV006    FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

  FLOW,CMS  %MAX-MIN %GREATER #GREATER       FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

    118.00   100.00     0.00        0
    116.82    99.00     0.03        2
    115.64    98.00     0.03        2
    112.11    95.00     0.03        2
    106.21    90.00     0.03        2
    100.32    85.00     0.03        2
     94.42    80.00     0.04        3
     88.53    75.00     0.04        3
     82.63    70.00     0.04        3
     76.74    65.00     0.07        5
     70.84    60.00     0.12        9
     64.95    55.00     0.15       11
     59.05    50.00     0.26       19
     53.16    45.00     0.33       24
     47.26    40.00     0.49       35
     41.37    35.00     0.78       56
     35.48    30.00     1.07       77
     32.53    27.50     1.36       98
     29.58    25.00     1.72      124
     26.63    22.50     2.17      156
     23.69    20.00     2.86      206
     20.74    17.50     3.82      275
     17.79    15.00     5.15      371
     14.84    12.50     6.97      502
     11.90    10.00    10.63      766
     10.72     9.00    12.35      890
      9.54     8.00    14.88     1072
      8.36     7.00    18.16     1308
      7.18     6.00    21.77     1568
      6.00     5.00    26.71     1924
      5.41     4.50    30.33     2185
      4.82     4.00    34.02     2451
      4.23     3.50    38.59     2780
      3.64     3.00    43.80     3155
      3.06     2.50    50.26     3621
      2.47     2.00    57.86     4169
      2.23     1.80    61.83     4454
      1.99     1.60    66.00     4755
      1.76     1.40    70.31     5065
      1.52     1.20    74.89     5395
      1.29     1.00    79.87     5754
      1.17     0.90    82.40     5936
      1.05     0.80    84.55     6091
      0.93     0.70    87.42     6298
      0.82     0.60    89.91     6477
      0.70     0.50    92.35     6653
      0.58     0.40    94.81     6830
      0.46     0.30    97.10     6995
      0.34     0.20    98.70     7110
      0.23     0.10    99.67     7180
      0.11    -0.00   100.00     7204
```



POINTE WOLFE RIVER AT
FUNDY NATIONAL PARK

Drainage Area 130 km^2
Natural Flow

```
STATION :   01BV007    FLOW                    UPPER SALMON RIVER NEAR ALMA
MONTHS SELECTED :   ALL MONTHS.
YEARS SELECTED :    ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :    0 %, I.E.      0 DAYS.

YEAR       MAX      MON DY       MIN       MON DY    TOT DAYS      MEAN         STD        MISSED
        FLOW,CMS              FLOW,CMS               DAY USED   FLOW,CMS     DEVIATION    MONTHS


1967      61.70    10 11        3.37      11 11      92   92      12.56        10.73      1  2  3  4  5  6  7  8  9
1968      43.90     3 24        0.34       8 24     366  366       5.75         6.65
1969      67.40     5 10        0.67       9  5     365  365       6.74         8.54
1970     108.00     2  4        0.71       1 30     365  365       6.64         9.56
1971      63.10     5  4        0.55       7 12     365  365       5.97         8.10
1972     153.00     5 16        1.25       3  2     366  366       9.32        12.96
1973      98.50    12 22        0.51      10 21     365  365       8.37         9.30
1974      77.60    12  9        0.67       8 22     365  365       6.60         7.63
1975     184.00    11 14        0.39       9  2     365  365       7.09        13.32
1976      63.10     1 28        0.40       7  8     366  366       7.94         8.60
1977      94.60    10  2        0.08       8 10     365  365       7.77         9.29
1978      70.80     5 10        0.22       8 29     365  365       5.31         8.26
1979      76.50     3 15        1.08       2 24      90   90      12.60        15.45      4  5  6  7  8  9 10 11 12


     STATION 01BV007 COMPLETED,    13 YEARS PROCESSED,   415 RECORDS PROCESSED.
 RECORDS SKIPPED ; WRONG DATA:    0, WRONG SEQUENCE:    0, YEAR NOT WANTED:    0, MONTH NOT WANTED:    0
```

```
STATION :   01BV007     FLOW
MONTHS SELECTED :    ALL MONTHS.
YEARS SELECTED :     ALL YEARS.
GOOD DATA REQUIRED FOR ANALYSIS :     0 %, I.E.      0 DAYS.

   FLOW,CMS  %MAX-MIN %GREATER #GREATER      . FLOW,CMS.  VS.  % GREATER THAN GIVEN FLOW

     154.00   100.00     0.00        0  I
     152.46    99.00     0.05        2  I
     150.92    98.00     0.05        2  I
     146.31    95.00     0.05        2  I
     138.62    90.00     0.05        2  I
     130.93    85.00     0.05        2  I
     123.24    80.00     0.05        2  I
     115.56    75.00     0.05        2  I
     107.87    70.00     0.07        3  I
     100.18    65.00     0.07        3  I
      92.49    60.00     0.12        5  I
      84.80    55.00     0.12        5  I
      77.11    50.00     0.14        6  I
      69.42    45.00     0.26       11  I
      61.73    40.00     0.45       19  I
      54.04    35.00     0.71       30  I
      46.35    30.00     1.07       45  I*
      42.51    27.50     1.48       62  I*
      38.67    25.00     2.00       84  I*
      34.82    22.50     2.36       99  I*
      30.98    20.00     2.98      125  I*
      27.13    17.50     3.83      161  I**
      23.29    15.00     5.52      232  I***
      19.44    12.50     7.67      322  I****
      15.60    10.00    11.45      481  I****$*
      14.06     9.00    13.69      575  I****$**
      12.52     8.00    15.98      671  I****$***
      10.98     7.00    18.74      787  I****$****
       9.45     6.00    22.40      941  I****$****$*
       7.91     5.00    27.48     1154  I****$****$****
       7.14     4.50    30.79     1293  I****$****$****$
       6.37     4.00    34.71     1458  I****$****$****$**
       5.60     3.50    38.76     1628  I****$****$****$****
       4.83     3.00    43.19     1814  I****$****$****$****$**
       4.07     2.50    48.76     2048  I****$****$****$****$****
       3.30     2.00    57.60     2419  I****$****$****$****$****$****
       2.99     1.80    61.38     2578  I****$****$****$****$****$****$*
       2.68     1.60    65.26     2741  I****$****$****$****$****$****$***
       2.37     1.40    69.26     2909  I****$****$****$****$****$****$****$
       2.07     1.20    73.33     3080  I****$****$****$****$****$****$****$**
       1.76     1.00    77.62     3260  I****$****$****$****$****$****$****$****
       1.61     0.90    79.93     3357  I****$****$****$****$****$****$****$****$
       1.45     0.80    82.74     3475  I****$****$****$****$****$****$****$****$*
       1.30     0.70    85.43     3588  I****$****$****$****$****$****$****$****$***
       1.14     0.60    88.05     3698  I****$****$****$****$****$****$****$****$****
       0.99     0.50    90.81     3814  I****$****$****$****$****$****$****$****$****$
       0.84     0.40    93.31     3919  I****$****$****$****$****$****$****$****$****$**
       0.68     0.30    95.57     4014  I****$****$****$****$****$****$****$****$****$***
       0.53     0.20    97.76     4106  I****$****$****$****$****$****$****$****$****$****
       0.37     0.10    99.55     4181  I****$****$****$****$****$****$****$****$****$****$
       0.22    -0.00   100.00     4200  I****$****$****$****$****$****$****$****$****$****$
                                        0---10---20---30---40---50---60---70---80---90--100
```

UPPER SALMON RIVER
NEAR ALMA

Drainage Area 181 km^2
Natural Flow

APPENDIX E

LOWFLOW FREQUENCY CURVES OF HYDROMETRIC STATIONS IN THE REGION

Introduction:

Low flow characteristics are commonly used to evaluate the adequacy of a stream in supplying the requirements for municipal and industrial water supplies, supplemental irrigation, maintenance of suitable conditions for fish, and waste disposal. These characteristics may be estimated, at a gauging station, by frequency curves, and by base-flow recession curves. Estimates of low flow characteristics for ungauged sites are generally quite inaccurate because low flow is highly dependent on the geology and the amount of evapotranspiration. However, estimates may be made if a few discharge measurements of base flow during one or more low flow seasons are available. Also, such estimates may be made from regionalized low flow frequency curves.

The reliability of low flow frequency curves which are based on natural flows is closely related to the period of record used in the analysis. Plans for utilization of low flows of a stream commonly are based on the low flows that have recurrence intervals of not more than 20 years of record are considered desirable. It was shown by (Riggs, 1972) that useful estimates of the 20-year annual minimum flow may be obtained by extrapolating flow frequency curves based on 10 or more years of record.

On the other hand, less than 10 annual events at a particular station are usually inadequate to define a low flow frequency curve. Such a station provides insufficient data for proper correlation with the concurrent part of a nearby station having a longer period of record. However, the relation between concurrent events (either annual minimums, daily mean base flows, or discharge measurements of base flows) can be used along with the frequency curve for the station that has the longer record, to approximate the 20-year annual minimum flow for the short record station.

In this appendix,five stations were selected for low flow analysis. The selection was made on the basis of the length of record, and only stations with ten years of record or more were selected. The stations used experienced natural flow conditions during their record periods.

Low flow frequency analysis was performed for the selected stations. Recurrence intervals of 1.05, 2, 5, 10, 20, 50, and 100 years were considered for durations of 1, 3, 7, 14, 30, 60, 90, and 120 days. The low flows and the unit low flows as well as the low flow frequency curves for each of the selected stations are presented in this appendix.

Reference:

Riggs, H.C. (1972), Techniques of Water Resources Investigations of the United States Geological Survey, Chapter B1, Low-Flow Investigations, Book 4, Hydrologic Analysis and Interpretation.

STATION NAME: 01BS001 COAL BRANCH RIVER AT BEERSVILLE

PERIOD OF RECORD: 1964 to PRESENT USED 1965 to 1976

DRAINAGE AREA: 166 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	0.434	0.465	0.466	0.528	0.650	1.431	2.124	2.478
2.0	0.187	0.189	0.225	0.244	0.296	0.474	0.696	0.940
5.0	0.114	0.118	0.135	0.147	0.187	0.237	0.317	0.436
10.0	0.090	0.096	0.099	0.111	0.150	0.168	0.200	0.256
20.0	0.076	0.084	0.076	0.088	0.129	0.132	0.138	0.148
50.0*	0.066	0.077	0.056	0.071	0.113	0.109	0.096	0.065
100.0*	0.062	0.074	0.047	0.063	0.106	0.100	0.080	0.029

*Unreliable due to Period of Extension

UNIT DISCHARGE (C.M.S./KM^2)

STATION NAME: 01BS001 COAL BRANCH RIVER AT BEERSVILLE

DRAINAGE AREA: 166 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND/KM^2 x 10^{-3}							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	2.614	2.801	2.807	3.181	3.916	8.620	12.795	14.928
2.0	1.127	1.139	1.355	1.470	1.783	2.855	4.193	5.663
5.0	0.687	0.711	0.813	0.886	1.127	1.428	1.910	2.627
10.0	0.542	0.578	0.596	0.669	0.9036	1.012	1.205	1.542
20.0	0.458	0.506	0.458	0.530	0.777	0.795	0.831	0.892
50.0*	0.398	0.464	0.337	0.428	0.681	0.657	0.578	0.392
100.0*	0.373	0.446	0.283	0.380	0.639	0.602	0.482	0.175

*Unreliable due to Period of Extension

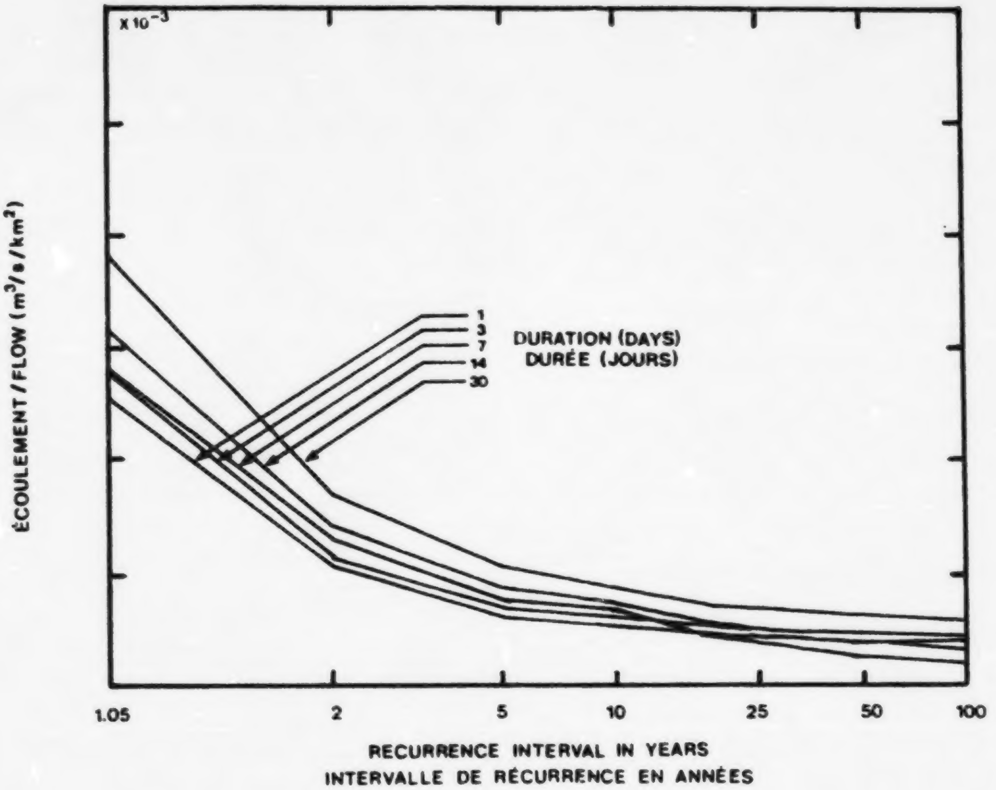
1965–1976

166 km²

TO GAUGE
A LA JAUGE

01BS001

COAL BRANCH RIVER AT BEERSVILLE
RIVIÈRE COAL BRANCH À BEERSVILLE



MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

LOWFLOW FREQUENCY ANALYSIS

ANALYSE DE LA FRÉQUENCE
DE FAIBLE ÉCOULEMENT

STATION NAME: 01BU002 PETITCODIAC RIVER NEAR PETITCODIAC

PERIOD OF RECORD: 1961 to PRESENT USED 1962 to 1976

DRAINAGE AREA: 391 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	0.845	0.886	0.990	1.180	1.537	2.336	4.495	5.132
2.0	0.400	0.412	0.444	0.520	0.655	1.077	1.594	2.054
5.0	0.241	0.253	0.280	0.315	0.395	0.606	0.746	1.011
10.0	0.180	0.195	0.225	0.244	0.309	0.420	0.466	0.629
20.0	0.141	0.160	0.194	0.202	0.260	0.300	0.308	0.395
50.0*	0.110	0.133	0.171	0.172	0.225	0.200	0.195	0.212
100.0*	0.095	0.121	0.162	0.158	0.210	0.152	0.148	0.129

*Unreliable due to Period of Extension

UNIT DISCHARGE (C.M.S./KM^2)

STATION NAME: 01BU002 PETITCODIAC RIVER NEAR PETITCODIAC

DRAINAGE AREA: 391 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND/KM^2 x 10^{-3}							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	2.161	2.266	2.532	3.018	3.931	5.974	11.496	13.125
2.0	1.023	1.054	1.136	1.330	1.675	2.754	4.077	5.253
5.0	0.616	0.647	0.716	0.806	1.010	1.550	1.908	2.586
10.0	0.460	0.499	0.575	0.624	0.790	1.074	1.192	1.609
20.0	0.361	0.409	0.496	0.517	0.665	0.767	0.788	1.010
50.0*	0.281	0.340	0.437	0.440	0.575	0.512	0.499	0.542
100.0*	0.243	0.309	0.414	0.404	0.537	0.389	0.379	0.330

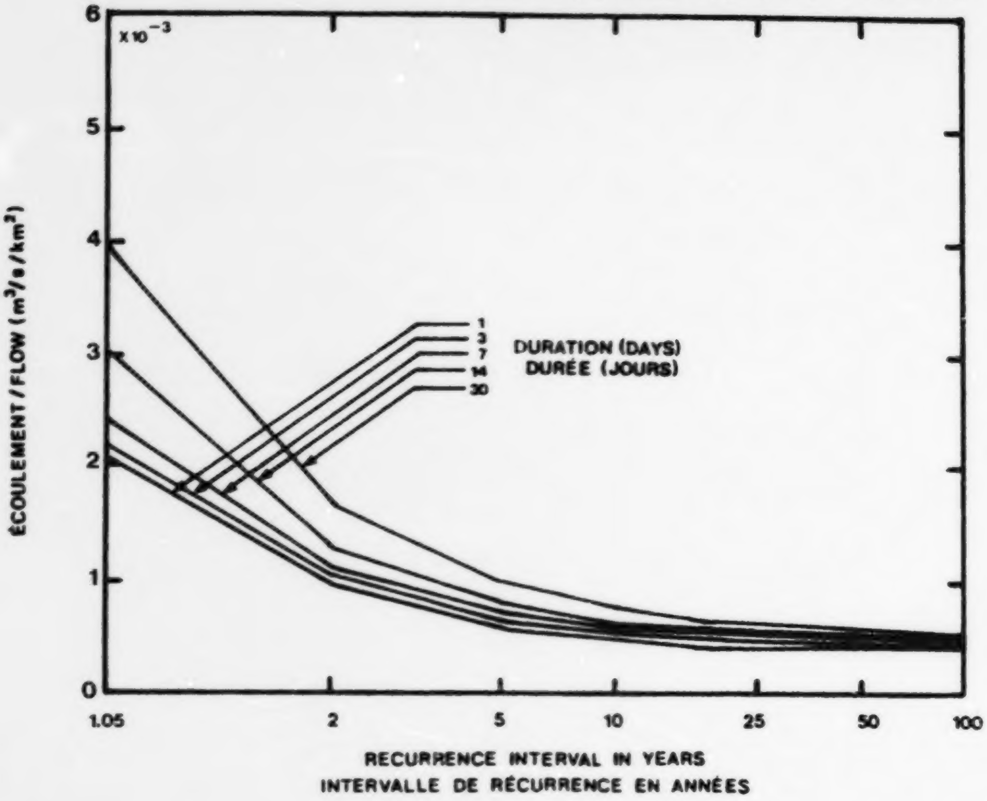
*Unreliable due to Period of Extension

1962 - 1976

391 km² TO GAUGE
A LA JAUGE

01BU002

PETITCODIAC RIVER NEAR PETITCODIAC
RIVIÈRE PETITCODIAC PRÈS DE PETITCODIAC



MONCTON PLANNING REGION
WATER RESOURCES REVIEW
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LOWFLOW FREQUENCY ANALYSIS

**ANALYSE DE LA FRÉQUENCE
DE FAIBLE ÉCOULEMENT**

STATION NAME: 01BU003 TURTLE CREEK AT TURTLE CREEK

PERIOD OF RECORD: 1962 to PRESENT USED 1963 to 1976

DRAINAGE AREA: 129 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	0.555	0.569	0.623	0.715	0.794	1.045	1.705	2.062
2.0	0.333	0.355	0.387	0.404	0.476	0.565	0.672	0.819
5.0	0.268	0.282	0.305	0.317	0.357	0.404	0.433	0.530
10.0	0.247	0.255	0.273	0.289	0.310	0.346	0.367	0.449
20.0	0.235	0.239	0.254	0.274	0.279	0.310	0.334	0.408
50.0*	0.226	0.226	0.239	0.263	0.254	0.282	0.313	0.383
100.0*	0.223	0.220	0.231	0.259	0.242	0.270	0.306	0.374

*Unreliable due to Period of Extension

UNIT DISCHARGE (C.M.S./KM^2)

STATION NAME: 01BU003 TURTLE CREEK AT TURTLE CREEK

DRAINAGE AREA: 129 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND/KM^2 x 10^{-3}							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	4.302	4.411	4.829	5.543	6.155	8.101	13.217	15.984
2.0	2.581	2.752	3.000	3.132	3.690	4.380	5.209	6.349
5.0	2.078	2.186	2.364	2.457	2.767	3.132	3.357	4.109
10.0	1.915	1.978	2.116	2.240	2.403	2.682	2.845	3.481
20.0	1.822	1.853	1.969	2.124	2.163	2.403	2.589	3.163
50.0*	1.752	1.752	1.853	2.039	1.969	2.186	2.426	2.969
100.0*	1.729	1.705	1.791	2.008	1.876	2.093	2.372	2.899

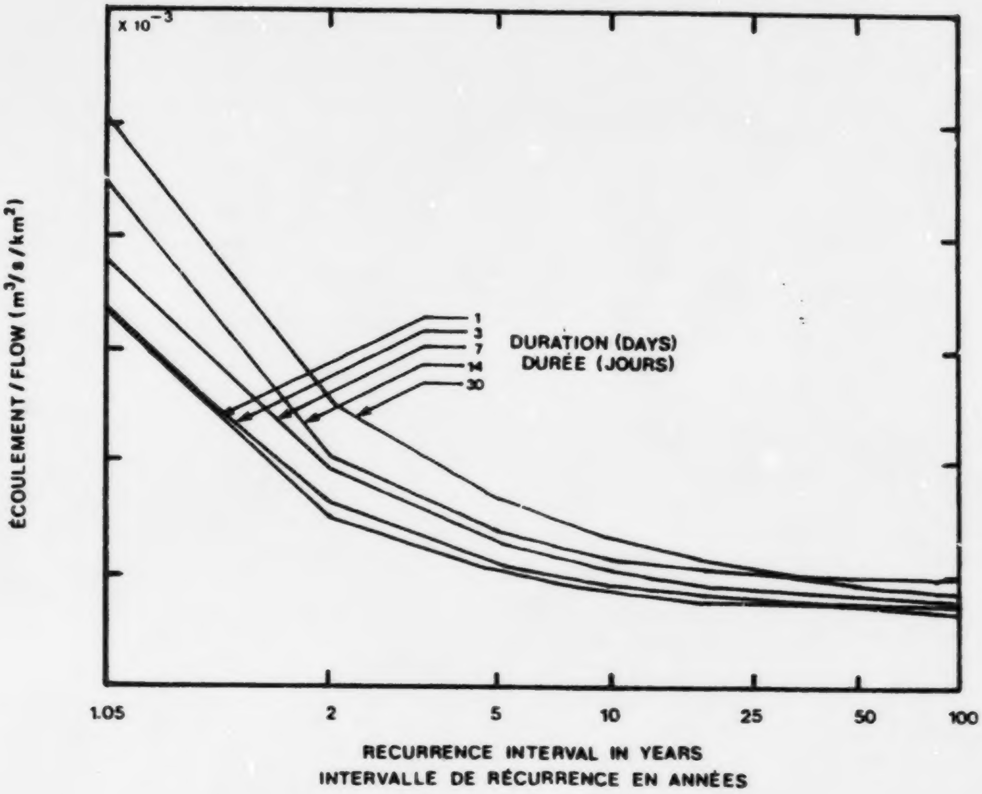
*Unreliable due to Period of Extension

1963–1976

129 km² TO GAUGE
A LA JAUGE

01BU003

TURTLE CREEK AT TURTLE CREEK
TURTLE CREEK À TURTLE CREEK



MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

LOWFLOW FREQUENCY ANALYSIS

ANALYSE DE LA FRÉQUENCE
DE FAIBLE ÉCOULEMENT

STATION NAME: 01BU004 PALMERS CREEK NEAR DORCHESTER

PERIOD OF RECORD: 1966 TO PRESENT USED 1966 to 1976

DRAINAGE AREA: 34.2 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	0.076	0.085	0.094	0.138	0.219	0.330	0.544	0.670
2.0	0.036	0.309	0.048	0.058	0.095	0.185	0.251	0.352
5.0	0.021	0.023	0.031	0.035	0.052	0.112	0.142	0.223
10.0	0.016	0.018	0.025	0.027	0.035	0.077	0.099	0.169
20.0	0.012	0.014	0.021	0.023	0.025	0.050	0.071	0.133
50.0*	0.009	0.012	0.018	0.020	0.016	0.023	0.048	0.101
100.0*	0.008	0.011	0.016	0.019	0.012	0.008	0.037	0.085

*Unreliable due to Period of Extension

UNIT DISCHARGE (C.M.S./KM^2)

STATION NAME: 01BU004 PALMERS CREEK NEAR DORCHESTER

DRAINAGE AREA: 34.2 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND/KM^2 x 10^{-3}							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	2.222	2.485	2.749	4.035	6.404	9.649	15.906	19.591
2.0	1.053	1.140	1.404	1.696	2.778	5.409	7.339	10.292
5.0	0.614	0.673	0.906	1.023	1.520	3.275	4.152	6.520
10.0	0.468	0.526	0.731	0.789	1.023	2.251	2.895	4.942
20.0	0.351	0.409	0.614	0.673	0.731	1.462	2.076	3.889
50.0*	0.263	0.351	0.526	0.585	0.468	0.673	1.404	2.953
100.0*	0.234	0.322	0.468	0.556	0.351	0.234	1.082	2.485

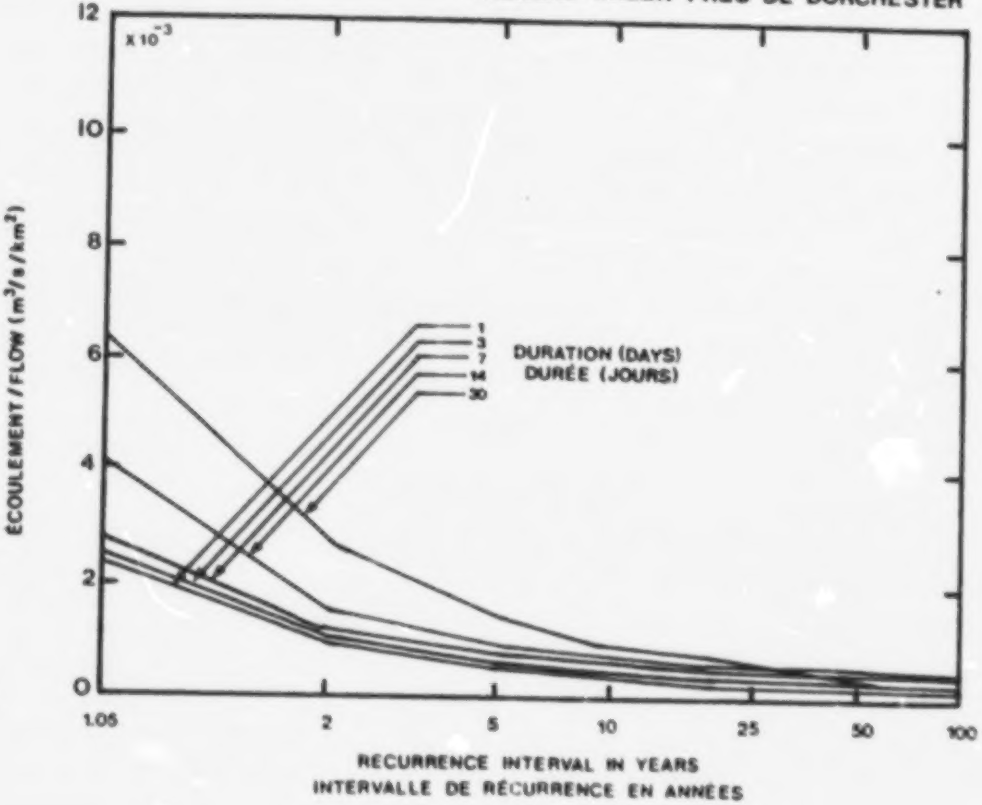
*Unreliable due to Period of Extension

1966-1976

$34.2\ km^2$ TO GAUGE
A LA JAUGE

01BU004

PALMERS CREEK NEAR DORCHESTER
PALMERS CREEK PRÈS DE DORCHESTER



MONCTON PLANNING REGION
WATER RESOURCES REVIEW
REGION D'AMÉNAGEMENT DE MONCTON
ETUDE DES RESSOURCES EN EAU

LOWFLOW FREQUENCY ANALYSIS

**ANALYSE DE LA FRÉQUENCE
DE FAIBLE ÉCOULEMENT**

STATION NAME: 01BV006 POINT WOLFE RIVER AT FUNDY PARK

PERIOD OF RECORD: 1964 TO PRESENT USED 1964 to 1976

DRAINAGE AREA: 130 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	0.786	0.822	0.856	0.981	1.366	3.289	3.662	3.880
2.0	0.391	0.422	0.470	0.531	0.659	1.111	1.586	1.974
5.0	0.243	0.264	0.303	0.358	0.439	0.644	0.959	1.331
10.0	0.185	0.198	0.230	0.289	0.364	0.521	0.747	1.096
20.0	0.147	0.155	0.180	0.243	0.320	0.462	0.625	0.953
50.0*	0.116	0.118	0.134	0.205	0.287	0.427	0.536	0.841
100.0*	0.101	0.099	0.109	0.186	0.273	0.415	0.499	0.791

*Unreliable due to Period of Extension

UNIT DISCHARGE (C.M.S./KM^2)

STATION NAME: 01BV006 POINT WOLFE RIVER AT FUNDY PARK

DRAINAGE AREA: 130 KM^2

RETURN PERIOD IN YEARS	LOWFLOW IN CUBIC METRES PER SECOND/KM^2 x 10^{-3}							
	LOWFLOW PERIOD IN DAYS							
	1	3	7	14	30	60	90	120
1.050	6.046	6.323	6.585	7.546	10.508	25.300	28.169	29.846
2.0	3.008	3.246	3.615	4.085	5.069	8.546	12.200	15.185
5.0	1.869	2.031	2.331	3.754	3.377	4.954	7.377	10.238
10.0	1.423	1.523	1.769	2.223	2.800	4.008	5.746	8.431
20.0	1.131	1.192	1.385	1.869	2.462	3.554	4.808	7.331
50.0*	0.892	0.908	1.031	1.577	2.208	3.285	4.123	6.469
100.0*	0.777	0.762	0.838	1.431	2.100	3.192	3.838	6.085

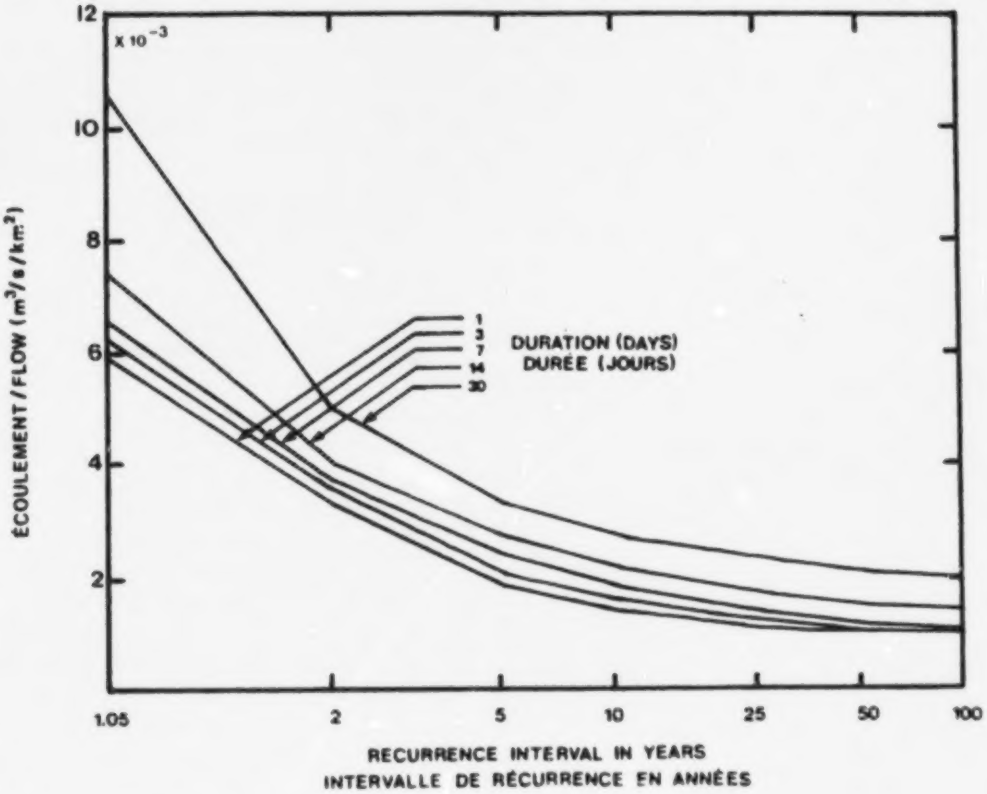
*Unreliable due to Period of Extension

1964 - 1976

130 km² TO GAUGE
A LA JAUGE

OIBVOO6

POINT WOLFE RIVER AT FUNDY PARK
RIVIÈRE POINT WOLFE A FUNDY PARK



MONCTON PLANNING REGION
WATER RESOURCES REVIEW
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ETUDE DES RESSOURCES EN EAU

LOWFLOW FREQUENCY ANALYSIS

ANALYSE DE LA FRÉQUENCE
DE FAIBLE ÉCOULEMENT

APPENDIX F

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES IN THE MONCTON PLANNING REGION

TABLE (F.1)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1AN

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
HORTON BROOK	10.9	16.6	5.7	5.8	.32	1.42
SOUTH FORKS BROOK	35.5	31.0	17.1	11.6	.26	1.46
HAZEN JAM BROOK	11.4	16.9	3.1	3.9	.74	1.41
ALDEN BROOK	4.7	9.9	3.0	3.6	.36	1.28
OTTER BROOK	16.4	26.2	8.8	5.2	.61	1.83
BEAR MEADOW CREEK	6.6	12.6	4.3	3.6	.51	1.38
CORDY BROOK	14.6	19.9	7.4	6.1	.39	1.46
TROUT BROOK	47.1	46.7	20.0	14.4	.23	1.91
SPRING BROOK	9.6	12.6	3.5	4.5	.47	1.15
DUNN BROOK	11.7	15.8	5.8	5.0	.47	1.30
BRIDGE MEADOW BROOK	6.6	10.2	3.8	3.6	.51	1.12
TOM OWENS BROOK	5.7	10.6	3.8	3.9	.37	1.25
LITTLE MICK BROOK	4.1	8.4	2.6	3.3	.38	1.17
BEAVER BROOK	15.2	19.7	7.1	7.1	.30	1.43
E.BRANCH LITTLE FORKS	34.9	29.0	14.7	13.1	.20	1.38
JOE WRAY BROOK	7.7	12.1	3.8	3.9	.51	1.23
NEVERS BROOK	21.4	22.1	10.7	8.3	.31	1.35
LITTLE FORKS STREAM	145.2	67.0	27.9	19.4	.39	1.57
MOSQUITO BROOK	2.0	8.0	1.4	2.6	.30	1.60
HAMILTON BROOK	3.8	8.3	2.4	3.3	.35	1.20
ALDEN BROOK	7.3	13.2	4.8	5.0	.29	1.38
GREY BROOK	8.5	15.2	5.3	5.9	.24	1.47
FULTON MEADOW BROOK	6.9	11.9	4.2	3.1	.71	1.28
FORKS STREAM	22.0	22.4	8.7	7.0	.88	1.35
STONY BROOK	8.2	12.3	5.1	5.0	.33	1.21
WEST BRANCH COY BROOK	22.3	19.6	8.5	6.6	.51	1.17
EAST BRANCH COY BROOK	22.0	20.6	8.4	7.7	.37	1.24
COY BROOK	62.0	40.2	14.7	11.2	.49	1.44

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.1)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1AN

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
LAKE STREAM	204.6	68.4	44.1	21.8	.43	1.35
CHERRY BROOK	30.7	26.7	7.1	9.7	.33	1.36
ALAGASH BROOK	10.2	14.5	5.2	4.7	.46	1.28
NELSON BROOK	13.6	16.8	3.5	4.1	.81	1.29
MOUNTAIN BROOK	11.8	14.2	4.6	4.6	.56	1.17
MCALLISTER BROOK	7.8	9.1	3.1	3.5	.64	.92
SECOND BRANCH	3.6	8.0	2.6	2.6	.53	1.19
GLEN BRANCH	24.9	16.6	5.1	6.7	.55	0.94
WHITE BROOK	6.4	12.2	3.6	5.2	.24	1.36
HORSESHOE BROOK	3.6	7.5	2.2	2.6	.53	1.11
MCLEOD BROOK	35.4	32.4	9.6	8.1	.54	1.54
MCGINLEY BROOK	4.1	8.6	3.1	3.4	.35	1.20
DOHERTY BROOK	6.6	10.9	4.3	4.0	.41	1.20
BIG FORKS STREAM	184.0	76.3	33.5	25.0	.29	1.59
LAMB BROOK	10.2	15.0	5.1	4.3	.55	1.32
FRIEL BROOK	24.3	17.3	7.0	6.5	.58	.99
RYAN BROOK	22.3	13.8	4.7	5.2	.82	.82
SALMON RIVER	1863.7	250.5	101.9	70.1	.38	1.64

***F.F. ≡ Form Factor**
#C.C. ≡ Compactness Coefficient
**** 1:250,000 scale**
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.2)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1AP

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
LIPSELT BROOK	15.1	19.4	8.0	7.6	.26	1.41
VAN BUSKIRK BROOK	16.0	16.3	6.9	5.6	.51	1.15
UPPER N.BRANCH CANAAN	39.4	30.8	10.2	10.4	.36	1.38
MIDDLE N.BRANCH CANAAN	30.2	21.8	7.6	7.4	.55	1.12
E.BRANCH CANAAN RIVER	29.5	25.6	7.4	8.8	.38	1.33
SOUTH BRANCH CAMPAN R	66.8	35.0	14.4	11.1	.54	1.21
DEAD BROOK	16.4	20.2	7.1	8.3	.24	1.41
FIVE MILE BROOK	27.4	21:6	7.9	6.2	.71	1.16
LOWER N.BRANCH CANAAN	54.6	44.9	23.3	15.5	.23	1.71
FIVE MILE BROOK	22.4	22.5	9.4	8.6	.30	1.34
FOUR MILE BROOK	6.0	12.9	4.9	5.4	.21	1.49
THREE MILE BROOK	10.9	13.9	2.0	5.1	.42	1.19
KILLAM MEADOW BROOK	6.5	11.0	2.7	4.1	.38	1.22
JORDAN MEADOW BROOK	7.1	12.7	3.0	4.7	.32	1.34
WILL TAYLOR BROOK	2.9	7.3	1.9	2.9	.34	1.21
DUNSTAN BROOK	3.4	7.1	1.9	2.4	.59	1.09
KEOHAN BROOK	8.8	12.9	3.4	4.6	.42	1.23
MURPHY MEADOW BROOK	18.7	21.7	6.9	7.0	.38	1.41
WILSON BROOK	28.5	23.3	7.4	7.4	.52	1.23
COREY BROOK	18.0	64.2	21.8	19.9	.20	1.48
KEITH BROOK	8.2	12.5	4.8	5.1	.32	1.23
PRICE BROOK	3.0	9.2	3.9	3.8	.21	1.50
RIDGE BROOK	47.7	35.1	20.1	16.9	.17	1.43
CANAAN RIVER	1558.5	205.3	87.0	68.9	.32	1.47

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.3)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BR

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
ESCUMINAC RIVER	29.8	21.2	7.6	8.4	.42	1.10
RIVIERE A L'ANGUILLE	49.2	29.2	15.6	10.6	.44	1.17
RIVIERE AU CONTAGE-SUD	7.5	13.2	5.5	5.6	.24	1.36
RIVIERE AU PORTAGE	69.9	49.5	21.9	20.0	.17	1.67
RUISSEAU A PIERFOT	7.9	15.8	3.0	6.8	.17	1.59
RUIS A GERMAIN	5.7	11.8	1.9	5.3	.20	1.39
CARSIGAN BROOK	14.2	17.7	8.5	7.5	.25	1.33
NORTH FORK BLACK RIVER	14.1	18.8	6.4	7.3	.26	1.41
RANKINE BROOK	42.5	29.5	13.9	12.3	.28	1.28
RIVIERE FONTAINE	29.3	27.5	13.3	11.6	.22	1.43
BLACK RIVER	133.1	49.0	20.5	18.5	.39	1.20
CAILS BROOK	4.6	9.5	3.6	3.9	.30	1.25
DALES BROOK	7.2	11.4	3.2	5.0	.29	1.20
SMITH BROOK	13.6	18.7	5.4	8.0	.21	1.43
FERRIS BROOK	11.5	21.2	8.9	7.9	.18	1.76
W.BRANCH RUSSEL BROOK	11.4	16.1	5.9	5.2	.42	1.35
E.BRANCH RUSSEL BROOK	9.5	13.8	3.8	5.0	.38	1.26
RUSSEL BROOK	24.7	22.2	8.9	7.3	.46	1.26
S.BRANCH KOUCHIBOUQUAC	30.4	25.6	11.9	10.8	.26	1.31
CHAPPEL BROOK	12.0	14.1	5.0	4.8	.52	1.15
S.BRANCH MCINNES BROOK	33.2	28.9	12.5	11.5	.25	1.41
N.BRANCH MCINNES BROOK	23.6	23.2	11.8	9.2	.28	1.35
MCINNES BROOK	66.4	36.9	18.4	15.2	.29	1.28
NO.BRANCH TWEEDIE BR.	34.6	31.8	15.5	10.7	.30	1.53
S.BRANCH TWEEDIE BROOK	13.9	18.3	7.4	7.1	.28	1.38
MACKAYS BROOK	25.4	23.3	9.5	8.6	.34	1.30
KOUCHIBOUQUAC RIVER	392.3	115.9	61.9	58.2	.12	1.65
RUISSEAU DES MAJOR	13.4	20.3	9.8	9.2	.16	1.56

***F.F. ≡ Form Factor**
#C.C. ≡ Compactness Coefficient
**** 1:250,000 scale**
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.3)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BR

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
BALDWINS BROOK	27.1	22.8	6.1	7.3	.51	1.23
NORTH FORKS	40.0	29.1	10.5	9.9	.41	1.29
SOUTH FORKS	12.6	16.2	8.1	6.4	.31	1.29
ROACH BROOK	11.1	13.4	3.5	4.9	.46	1.13
UPPER MEADOW BROOK	6.3	14.8	4.5	5.3	.22	1.66
LOWER MEADOW BROOK	10.2	14.1	3.6	4.8	.44	1.25
KATES BROOK	3.9	8.0	2.0	2.8	.50	1.14
QUARRY BROOK	8.3	13.2	2.9	5.5	.27	1.29
KINGSTON BROOK	8.8	11.6	2.7	4.3	.48	1.10
BURNT CAMP BROOK	3.3	9.3	2.8	3.5	.27	1.44
BEAVER BROOK	4.2	8.2	2.1	2.8	.54	1.13
LITTLE BEAVER BROOK	3.8	7.7	2.3	3.1	.40	1.11
RUISSEAU DE LA TRUITE-SUD	17.3	20.9	8.3	9.2	.20	1.42
RUISSEAU DE LA TRUITE	62.6	36.1	16.7	12.9	.38	1.29
RUISSEAU A PIERRE A JEAN	3.8	8.4	2.8	3.2	.37	1.22
RUISSEAU DES BABINEAU	8.9	14.9	4.6	5.9	.26	1.41
RUIS A BAPTISTE	3.2	7.1	3.0	3.0	.36	1.12
RUISS A PETIT PIERRE	3.6	8.1	2.4	2.7	.49	1.20
RUISS A MAXIME	1.7	6.1	1.4	2.6	.25	1.32
RUISSEAU DES CANARDS	6.8	11.8	4.0	5.2	.25	1.28
KOUCHIBOUQUASIS RIVER	131.3	130.7	68.6	58.6	.38	3.2
RUISSEAU A ANTOINE-ALLAIN	12.9	13.7	4.7	5.2	.48	1.08
BIG BROOK	18.5	20.3	7.0	8.2	.28	1.33
RIVIERE AUX MASOUIS	5.3	9.7	2.2	4.0	.33	1.19
PETITE RIVIERE ALDOUANE	11.9	14.4	5.3	6.0	.33	1.18
THOMAS BROOK	1.3	4.8	1.2	2.1	.29	1.19
RIVIERE ST-CHARLES	117.9	50.1	23.2	20.0	.29	1.30

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.4)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BS

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
HECTOR FORK	7.6	13.2	4.5	5.7	.23	1.35
JIMMY GRAHAM FORK	37.2	30.0	12.2	11.7	.27	1.39
SMITH MEADOW BROOK	8.8	12.9	5.1	4.2	.50	1.23
TAYLOR BROOK	10.9	17.9	5.3	6.8	.24	1.53
KELLOCK BROOK	2.3	7.0	1.5	2.7	.32	1.30
CRAIGY BROOK	0.5	2.8	0.7	1.2	.35	1.12
FLAGGY BROOK	3.3	8.7	2.2	3.1	.34	1.35
COLD SPRING BROOK	4.5	11.9	2.7	4.2	.26	1.58
HUDSON BROOK	29.6	28.1	11.4	10.5	.27	1.46
DAVIES BROOK	4.0	9.9	3.8	3.9	.26	1.40
DUFFS BROOK	3.9	10.6	2.7	4.1	.23	1.51
TROUT BROOK	66.1	47.7	22.3	15.3	.28	1.66
LITTLE COAL BRANCH R.	7.9	13.0	6.9	5.5	.26	1.30
S.FORKS COAL BRANCH R.	32.2	26.0	10.5	9.3	.37	1.29
N.FORKS COAL BRANCH R.	31.9	27.2	12.5	9.4	.36	1.36
SNAKE BROOK	5.8	11.5	3.6	4.1	.35	1.35
BROWNS BROOK	25.7	24.5	10.8	8.5	.36	1.36
DONALD BROOK	6.2	10.2	2.7	3.4	.54	1.16
BLIND BROOK	14.8	16.7	7.0	5.1	.57	1.22
BIG BROOK	18.0	23.0	8.3	8.8	.23	1.53
JAMES CARRUTHERS BROOK	4.4	10.6	2.9	3.3	.40	1.43
FARREN BROOK	3.0	7.6	2.7	2.7	.41	1.24
TOM IRVING BROOK	2.0	7.6	1.5	3.2	.20	1.52
DAVID CARRUTHERS BROOK	2.1	5.9	1.9	2.2	.43	1.15
MCWILLIAM BROOK	2.3	6.0	2.2	2.1	.52	1.12
MACINTOSH BROOK	2.2	7.2	3.4	2.6	.33	1.37
POWELLS BROOK	2.9	9.5	3.0	3.4	.25	1.57
CLARES CREEK	3.7	7.7	2.9	2.9	.44	1.13

***F.F. ≡ Form Factor**
#C.C. ≡ Compactness Coefficient
**** 1:250,000 scale**
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.4)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BS

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape F.F.*	Basin Shape C.C.#
COAL BRANCH RIVER	213.1	83.8	35.1	26.9	.29	1.62
BELLS CREEK	7.0	11.9	4.9	4.8	.30	1.27
WATERLOU BROOK	5.5	12.0	3.4	3.8	.38	1.44
LITTLE NORTH FORK	7.2	11.5	3.1	3.9	.47	1.21
BIG NORTH FORK	11.2	16.0	5.6	5.8	.33	1.35
FRASER BROOK	5.7	11.6	2.4	5.3	.20	1.37
JIM YOUNG BROOK	3.2	8.0	2.3	3.2	.31	1.26
SOUTH BROOK	10.0	13.0	4.5	4.8	.43	1.16
WHALEN BROOK	3.4	8.2	2.5	2.7	.47	1.25
MCDONALD BROOK	1.7	5.6	1.1	2.5	.27	1.21
BEAVER POND BROOK	2.8	6.6	1.4	1.9	.78	1.11
STEWART BROOK	7.9	11.8	3.3	4.7	.36	1.18
BASS RIVER	116.0	62.8	32.3	24.9	.19	1.64
GEORGE BEERS CREEK	3.8	8.3	1.9	3.5	.31	1.20
NAPIER BROOK	5.5	11.2	3.9	4.5	.27	1.35
N.FORKS MOLUS RIVER	16.6	16.9	5.2	5.1	.64	1.17
MCCAFFERTY BROOK	2.9	6.8	2.3	2.1	.65	1.13
DARGAVES BROOK	9.6	14.6	3.4	4.9	.40	1.33
BIG BROOK	4.8	8.6	1.2	3.2	.47	1.11
BIRCH CREEK	1.4	4.9	1.2	2.0	.35	1.17
MOLUS RIVER	94.6	50.6	24.2	20.7	.22	1.47
MCKAYS CREEK	5.0	9.8	4.2	3.8	.35	1.24
BIG COVE CREEK	15.6	19.8	6.4	7.8	.26	1.41
GASPEREAU CREEK	12.9	18.6	4.6	6.4	.31	1.46
MURPHY BROOK	15.6	18.6	7.2	5.5	.52	1.33
S.BRANCH ST NICHOLAS R	66.4	38.9	18.6	14.4	.32	1.35
W.BRANCH ST NICHOLAS R	55.0	41.5	16.4	13.7	.29	1.58
SPRING BROOK	5.5	9.5	3.1	3.5	.45	1.14

***F.F. ≡ Form Factor**
#C.C. ≡ Compactness Coefficient
**** 1:250,000 scale**
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.4)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BS

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
BLACK BROOK	19.0	20.0	6.1	5.8	.56	1.29
E.BRANCH ST NICHOLAS R	60.9	38.3	16.5	11.0	.50	1.38
MILL CREEK	16.8	19.9	7.3	8.0	.26	1.37
WATERING CREEK	2.8	7.0	2.0	2.3	.53	1.18
CHILDS CREEK	13.0	15.8	4.7	5.5	.43	1.24
BEATTIES CREEK	10.1	14.0	3.1	4.6	.48	1.24
WELDON CREEK	7.8	11.5	3.6	4.5	.39	1.16
MOONEYS CREEK	5.5	11.1	3.2	4.5	.27	1.34
GASPEREAU CREEK	27.1	26.5	11.3	10.2	.26	1.44
RUIS DES RICHARD	1.6	5.1	0.7	1.7	.55	1.14
RUIS A CLARICE-LEGERE	2.4	6.6	2.2	2.8	.31	1.20
RUISSEAU A JOS-ALLAIN	3.2	8.3	2.5	3.4	.28	1.31
RIVIERE A ETIENNE	9.2	14.5	5.4	4.6	.43	1.35
RIVIERE DU CAP	18.2	9.0	3.1	3.4	1.57	.60
RIVIERE DES VACHES	11.9	7.2	1.3	3.0	1.32	.59
RIVIERE CHOCKPISH NORD	27.7	21.4	8.3	7.8	.46	1.15
RIVIERE CHOCKPISH	61.2	39.2	12.4	11.5	.46	1.41
IRVING BROOK	3.2	7.7	2.5	2.7	.44	1.21
RUIS GEORGES-COLLETTE	9.6	13.1	4.2	4.5	.47	1.19
BLACK RIVER	35.0	32.1	15.5	12.8	.21	1.53
UPPER N.BRANCH BUCTOUCHE R	38.8	30.0	13.6	11.7	.28	1.36
RICHARD BROOK	13.0	16.3	6.2	7.1	.26	1.28
LUKE BROOK	28.3	28.0	9.6	7.7	.48	1.48
MEADOW BROOK	6.7	14.9	5.5	6.5	.16	1.62
JOHNSTON BROOK	46.0	30.8	7.9	9.9	.47	1.28
MCLEAN BROOK	23.8	21.7	8.6	6.9	.50	1.25
YANKEE BROOK	20.8	23.1	8.1	9.1	.25	1.43
BAILEY BROOK	10.2	23.2	6.1	7.7	.17	2.05

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.4)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BS

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
ALBERT BROOK	9.3	13.3	5.2	5.1	.36	1.23
S.BRANCH BUCTOUCHE R.	102.4	48.0	25.5	19.0	.28	1.34
TROUT BROOK	20.9	29.9	13.3	11.6	.16	1.84
RUSHCOVE BROOK	17.6	19.9	8.0	8.4	.25	1.34
NORMAN BRIDGE BROOK	5.2	10.9	3.8	4.3	.28	1.35
MILLERS BROOK	3.4	9.9	3.0	3.9	.22	1.51
MCNAIN BROOK	0.5	3.2	0.9	1.4	.26	1.28
MILL CREEK	44.1	41.1	15.9	14.0	.23	1.75
NOEL CREEK	11.9	16.8	7.2	5.8	.35	1.37
BUCTOUCHE RIVER	462.6	133.2	53.9	40.8	.28	1.48
BREAU BROOK	16.1	19.6	8.8	6.4	.39	1.38
BASTARCHE BROOK	9.6	14.9	4.3	5.8	.29	1.36
SMELT BROOK	18.0	21.3	8.4	7.6	.31	1.42
LITTLE BUCTOUCHE RIVER	84.4	47.0	18.3	17.1	.29	1.44
BIGGS BROOK	18.2	24.5	10.3	10.4	.17	1.62
RUIS DES MALCONTENTS	9.6	12.1	4.0	4.1	.57	1.10
HOWARD BROOK	18.9	22.9	9.0	8.9	.24	1.49
RUIS DES GOGUEN	11.9	19.6	4.5	8.3	.17	1.60
NORTH BRANCH COGAGNE R	12.1	20.5	20.0	7.4	.22	1.66
SHAW BROOK	19.0	19.6	7.5	7.6	.33	1.27
BUTLER CREEK	7.9	12.2	4.6	5.0	.32	1.22
MEADOW BROOK	21.2	24.1	9.1	6.7	.47	1.48
NORTHWEST BRANCH COGAGNE	63.5	38.8	17.3	11.9	.45	1.37
RUIS DES ORMEAUX	7.4	13.5	5.0	5.3	.26	1.40
RUIS DES DUPUIS	3.5	9.3	4.2	3.9	.23	1.40
RUISSEAU BABINEAU	8.2	14.1	5.9	5.9	.24	1.39
RIVIERE A L'ANGUILLE	16.7	18.4	7.3	6.6	.38	1.27
PETIT VUIS GOGUEN	2.5	6.6	1.5	2.6	.37	1.18

*F.F. ≡ Form Factor

#C.C. ≡ Compactness Coefficient

** 1:250,000 scale

Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.4)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BS

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
RUISSEAU CORMIER	4.3	10.5	3.3	3.6	.33	1.43
RUIS FRANCOIS	5.0	11.1	2.4	4.0	.31	1.40
MURRAY BROOK	26.0	28.7	11.4	11.8	.19	1.59
COCAGNE RIVER	297.3	108.3	46.7	40.3	.18	1.77
ROBIN CREEK	6.9	10.4	1.8	2.9	.82	1.12
RUIS ALBERT-GALLANT	4.7	9.4	3.6	3.6	.36	1.22
MCQUADE BROOK	29.3	29.2	13.1	11.3	.23	1.52
CALHOUN BROOK	18.5	23.3	10.6	9.7	.20	1.53
WEISNER BROOK	58.6	38.8	14.9	11.7	.43	1.43
BATEMANS BROOK	36.6	29.1	12.2	10.4	.34	1.36
SHEDIAC RIVER	221.8	80.1	39.1	28.1	.28	1.52

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.5)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BT

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
SCOUDOUC RIVER	151.8	60.6	28.3	14.6	.71	1.39
RUIS DES GAUDET	4.3	9.2	1.8	3.2	.42	1.25
BEAR CREEK	12.1	19.3	7.7	7.1	.24	1.57
KINNEAR RIVER	41.3	40.5	18.1	15.9	.16	1.78
MILL CREEK	2.5	7.0	2.8	2.9	.30	1.25
ABOUJAGGNE RIVER	51.5	36.4	14.5	11.9	.36	1.43
LAKE BROOK	10.0	16.7	6.3	5.0	.40	1.49
KOUCHIBOUQUAC RIVER	55.8	42.6	14.8	12.1	.38	1.61
FRIEL BROOK	10.8	17.3	4.3	5.9	.31	1.49
TEDISH BROOK	30.0	29.8	10.9	8.8	.39	1.53
LEGER BROOK	6.0	11.2	3.0	4.5	.30	1.29
LITTLE CAPE BROOK	5.3	11.3	3.4	3.9	.35	1.38
COPP BROOK	9.7	15.2	5.5	6.1	.26	1.38
AVARD BROOK	13.7	16.0	5.4	5.8	.41	1.22
NILES BROOK	4.4	8.4	2.6	3.2	.43	1.13
FOX BROOK	18.2	19.2	6.0	4.9	.76	1.27
LOUIS BROOK	1.2	4.4	1.1	1.5	.53	1.13
CHAPMAN BROOK	22.4	27.4	10.8	8.3	.33	1.63
MCKAYS CREEK	18.1	20.9	8.9	8.2	.27	1.39
AMOS CREEK	6.7	11.1	4.7	4.1	.40	1.21
GRANT CREEK	6.4	12.3	5.1	4.8	.28	1.37
TROUT CREEK	14.7	20.0	8.1	8.7	.19	1.47
SCOTT BROOK	24.1	23.1	9.5	8.7	.32	1.33
TRENTHOLM BROOK	7.2	11.9	3.8	4.6	.34	1.25
PEACOCK BROOK	8.1	10.9	1.5	3.5	.66	1.08
MCKAY BROOK	6.6	12.4	4.1	4.8	.29	1.36
OULTEN BROOK	12.2	15.3	5.8	5.8	.36	1.24
BARRY BROOK	10.7	14.5	4.5	5.2	.40	1.25

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.5)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BT

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
RAYWORTH BROOK	12.0	16.1	7.2	6.1	.32	1.31
WARD BROOK	5.7	11.9	5.4	4.9	.24	1.41
MATT BROOK	10.9	18.8	8.3	7.5	.19	1.61
TIMBER RIVER	27.3	23.9	7.4	7.2	.53	1.29
SIMPSON BROOK	7.5	12.6	4.8	4.5	.37	1.30
LITTLE BOBBY KAYE BROOK	10.8	15.7	5.5	6.0	.30	1.35
FARBY BROOK	24.1	25.2	5.0	7.0	.49	1.45
TRENHOLM BROOK	9.8	17.3	7.1	7.2	.19	1.56
GASPEREAU RIVER	130.7	70.4	34.0	19.6	.34	1.74
HARTLEY BROOK	6.4	17.4	6.6	7.6	.11	1.94
BAXTER BROOK	10.6	19.2	7.0	7.1	.21	1.66
CHAPPELL BROOK	18.8	23.1	8.3	7.2	.36	1.50
ALLEN BROOK	10.8	16.8	6.4	5.2	.40	1.44
MILL BROOK	3.3	9.9	3.0	5.8	.10	1.54
GOODEN BROOK	2.9	7.7	3.0	3.1	.30	1.28
SMELT BROOK	5.9	10.7	2.7	3.9	.39	1.24
MISSAGUASH RIVER	74.0	54.2	26.8	20.4	.18	1.78
EAST BROOK	16.9	25.0	11.5	6.7	.38	1.72
WEST BROOK	4.9	10.6	2.1	3.6	.38	1.35
LONG LAKE BROOK	7.2	13.8	4.9	5.2	.27	1.45
MISQUASH BROOK	12.1	16.6	6.3	6.0	.34	1.35
HARPER BROOK	15.1	19.5	9.2	7.4	.28	1.42
JENKS BROOK	21.4	26.8	8.9	9.8	.22	1.63
MORICE BROOK	59.5	40.1	20.8	13.9	.31	1.47
FROSTY HOLLOW BROOK	45.5	28.1	11.1	9.0	.56	1.18
AULAC BROOK	64.9	46.0	15.9	18.7	.19	1.61
TANTRAMAR BROOK	202.0	53.6	21.3	15.4	.85	1.06
WOOD CREEK	5.9	9.9	3.5	3.8	.41	1.15

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.5)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BT

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
ALLEN CREEK	6.3	11.4	3.0	3.5	.51	1.28
HARVEY CREEK	6.7	10.7	3.5	3.4	.58	1.17
JOHNSON CREEK	23.0	22.5	8.5	8.6	.31	1.32
TOWER BROOK	4.4	8.1	2.8	2.7	.60	1.09

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.6)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BU

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
BLAKENEY BROOK	11.2	16.8	5.6	4.7	.51	1.42
MONTGOMERY BROOK	5.4	12.0	3.7	4.5	.27	1.46
MCLEOD BROOK	4.3	10.1	4.1	4.2	.24	1.37
LOUIS MOUNTAIN BROOK	5.3	11.8	4.2	5.1	.20	1.45
WALKER BROOK	3.5	10.0	4.1	4.1	.21	1.51
KILLAM BROOK	11.9	21.2	7.1	6.3	.30	1.73
BLAKNEY BROOK	6.7**	12.1	5.4	5.0	.27	1.32
GORDON BROOK	7.8	12:2	3.9	4.1	.46	1.23
BENNETT BROOK	30.7	23.9	8.9	8.3	.45	1.22
SALT SPRINGS BROOK	29.7	29.5	12.4	11.9	.21	1.53
NORTH RIVER	290.2	82.8	32.1	26.1	.43	1.37
HARPER BROOK	6.2	13.0	4.5	4.4	.32	1.47
HAYWARD BROOK	32.1	26.8	10.3	9.4	.36	1.33
HOLMES BROOK	25.1	22.7	10.7	8.5	.35	1.28
ANAGANCE RIVER	144.5	59.2	24.3	18.0	.45	1.39
O'BLENIS BROOK	7.0	12.4	5.4	5.1	.27	1.32
TRITES BROOK	3.0	10.0	1.6	3.1	.31	1.63
NIGUS BROOK	13.5	18.2	7.1	7.5	.24	1.40
CHAPMAN BROOK	8.3	11.7	3.7	4.4	.43	1.15
HASTY BROOK	6.4	13.8	6.8	4.5	.32	1.54
MCMAIN BROOK	1.1	4.7	1.0	1.4	.56	1.26
GRASSY LAKE BROOK	3.5	7.8	2.1	2.5	.56	1.18
BUSTEN BROOK	3.9	7.8	2.5	3.0	.43	1.11
MECHANIC LAKE BROOK	10.8	16.3	5.2	5.3	.38	1.40
CAMPBELL BROOK	7.7	13.1	5.5	5.5	.25	1.33
KELLY BROOK	31.3	27.2	9.9	7.5	.56	1.37
HASLAM BROOK	7.3	11.4	4.6	4.2	.41	1.19
SHAFFER BROOK	8.3	12.2	4.4	3.7	.61	1.19

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.6)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BU

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape F.F.*	Basin Shape C.C.#
PINNACLE BROOK	3.2	8.5	2.8	3.6	.25	1.34
GIBSON BROOK	6.5	12.1	3.7	5.1	.25	1.34
STEEVES BROOK	2.2	6.0	2.5	2.3	.42	1.14
BARCHARD BROOK	2.0	6.0	1.6	2.5	.32	1.20
LEE BROOK	8.3	15.5	4.8	4.8	.36	1.52
WEBSTER BROOK	22.7	20.7	7.7	7.2	.44	1.23
MAPLETON BROOK	4.8	10.7	4.0	4.0	.30	1.38
MILLER BROOK	7.9	12.0	4.2	4.5	.39	1.20
POPPLE INTERVALE BROOK	10.2	16.9	6.7	6.5	.24	1.49
DRY BROOK	3.0	7.5	2.5	2.8	.38	1.22
COLPITTS BROOK	14.4	20.3	8.8	7.3	.27	1.51
BABCOCK BROOK	25.5	26.1	8.2	8.1	.39	1.46
POLLETT RIVER	309.4	112.6	51.8	38.6	.21	1.81
DUNCAN BROOK	10.4	15.5	4.9	4.6	.49	1.35
BANNISTER BROOK	26.1	20.8	9.2	6.6	.60	1.15
FRENCH BROOK	4.6	9.6	3.5	4.0	.29	1.26
FERNDALE BROOK	8.4	12.6	3.6	4.1	.50	1.23
BLACKWOOD BROOK	7.6	13.5	4.7	5.3	.27	1.38
E.BRANCH LITTLE RIVER	19.3	25.9	9.1	7.9	.31	1.66
MILTON BROOK	11.7	16.3	3.9	3.9	.77	1.34
UPHAM BROOK	6.5	12.4	3.8	4.7	.29	1.37
HAYWARD BROOK	11.7	18.2	6.2	6.6	.27	1.50
BEAMAN BROOK	7.3	13.5	4.6	4.6	.34	1.41
PROSSER BROOK	50.8	29.9	8.9	10.0	.51	1.18
POW BROOK	13.3	16.6	6.8	6.6	.31	1.28
HOPPER BROOK	6.3	11.6	3.6	4.8	.27	1.30
BULL CREEK	3.0	6.9	1.9	3.0	.33	1.12
LEAMAN BROOK	20.2	22.6	9.4	8.1	.31	1.42

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.6)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BU

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
STILES BROOK	17.5	22.8	8.3	9.3	.20	1.54
DECKER BROOK	9.4	12.7	4.0	5.3	.33	1.17
LITTLE RIVER	297.6	91.7	43.2	31.6	.30	1.50
MCNAUGHTON BROOK	5.1	12.4	4.4	5.8	.15	1.55
INTERVALE CREEK	16.9	23.3	7.8	6.1	.45	1.60
BOUNDARY CREEK	7.0	11.7	4.0	4.7	.32	1.25
LAKE CREEK	1.7	5.9	2.6	2.3	.32	1.28
ISLAND CREEK	11.5	14.2	5.2	5.0	.46	1.18
SOMERS CREEK	14.7	22.4	9.3	8.3	.21	1.65
MILL BROOK	0.9	3.7	0.9	1.5	.40	1.10
BALTIMORE CREEK	3.0	7.2	2.7	2.8	.38	1.17
STUART BROOK	4.2	8.5	3.0	3.0	.47	1.17
CARSON BROOK	2.6	7.4	3.4	3.5	.21	1.29
PATTERSON BROOK	5.0	9.7	3.1	3.4	.43	1.22
BERRY BROOK	7.1	13.2	5.9	5.0	.28	1.40
DRYDEN BROOK	5.7	12.6	4.5	4.4	.29	1.49
BEAVER BROOK	6.5	10.4	3.8	3.9	.43	1.15
BRAY BROOK	0.6	2.8	0.7	0.9	.74	1.02
BIG SPRING BROOK	1.0	4.9	1.5	1.9	.28	1.38
RANDALL BROOK	2.3	6.2	2.3	2.6	.34	1.15
MOLLENS BROOK	2.1	7.3	2.7	2.9	.25	1.42
GODFREY BROOK	3.6	10.0	3.6	4.1	.21	1.49
DOWNEY BROOK	6.3	13.3	1.4	5.1	.24	1.49
E.BRANCH TURTLE CREEK	48.2	35.9	16.2	11.2	.38	1.46
MEADOW BROOK	12.3	17.7	5.4	7.6	.21	1.42
CARIBOU BROOK	8.0	13.5	4.7	5.2	.30	1.35
TURTLE CREEK	204.1	73.4	35.2	27.6	.27	1.45
MICHAELS CREEK	9.8	13.0	6.6	4.8	.43	1.17

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.6)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BU

Name of watercourse	Drain-age Area (sq.Km)	Basin Peri-meter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
MILNER BROOK	1.4	4.9	1.8	1.9	.39	1.17
RABBIT BROOK	9.7	13.9	4.6	5.5	.32	1.26
JOHATHAN CREEK	46.0	38.3	19.2	14.9	.21	1.59
GORGE BROOK	11.2	15.6	5.9	4.6	.53	1.31
W.BRANCH HALLS CREEK	22.6	23.5	11.8	9.5	.25	1.39
OGILVIE BROOK	25.2	24.3	11.5	6.7	.56	1.37
N.BRANCH HALLS CREEK	48.8	34.4	9.3	8.8	.63	1.39
COOKS BROOK	4.3	8.4	3.0	3.4	.37	1.14
HUMPHREYS BROOK	35.6	31.9	12.2	10.1	.35	1.51
HALLS CREEK	124.8	56.8	13.7	12.5	.80	1.43
BABINEAU BROOK	9.4	12.2	4.5	4.2	.53	1.12
BRYDON BROOK	14.7	16.6	6.8	5.6	.47	1.22
MILL CREEK	41.3	37.9	16.3	11.5	.31	1.66
MUD CREEK	12.5	19.7	5.1	7.5	.22	1.57
FOX CREEK	35.1	25.8	8.5	7.3	.66	1.23
GRINDSTONE CREEK	3.6	8.9	3.3	4.1	.21	1.32
STEEVES CREEK	2.7	8.8	2.9	3.5	.22	1.51
MCFARLANE CREEK	5.8	12.1	4.4	4.7	.26	1.42
STONEY CREEK	20.4	23.2	7.3	7.7	.34	1.45
DOWNING CREEK	50.4	14.9	6.2	5.2		
ELLIOTT BROOK	3.0	5.1	1.2	2.3		
BOYD CREEK	8.9	14.7	6.0	5.1	.34	1.39
SHAW BROOK	5.3	10.4	3.1	3.3	.49	1.27
PECK CREEK	10.8	17.6	6.6	5.9	.31	1.51
FREDERICK BROOK	8.2	16.7	6.0	4.6	.39	1.65
BULL CREEK	13.7	16.4	5.5	6.8	.30	1.25
CAL CREEK	3.9	9.2	3.8	4.1	.23	1.31
HOPPER CREEK	8.8	14.6	5.1	5.9	.25	1.39

*F.F. ≡ Form Factor

#C.C. ≡ Compactness Coefficient

** 1:250,000 scale

Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.6)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BU

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
HIRAM BROOK	12.4	20.0	6.5	7.2	.24	1.60
WELDON CREEK	92.9	42.9	18.9	15.0	.41	1.26
UPPER CREEK	1.3	4.6	1.3	2.0	.33	1.14
GRAY BROOK	12.5	17.5	6.8	5.2	.46	1.40
BELLIVEAU CREEK	9.5	15.6	4.6	4.8	.41	1.43
BOUDREAU CREEK	2.8	8.2	3.6	3.6	.22	1.38
CANADIAN BROOK	29.8	11.9	2.6	4.0	1.86	.41
MINORS BROOK	12.6	8.0	2.1	3.0	1.4	.64
BENNETT BROOK	3.5	8.9	2.7	2.9	.42	1.34
PETITCODIAC RIVER	2071.6	244.8	96.6	59.7	.58	1.52
S.BRANCH MEMRAMCOOK R	15.5	19.0	8.6	7.9	.25	1.36
MEADOW BROOK	36.0	28.7	8.0	8.5	.50	1.35
PRAIRIE BROOK	13.5	19.7	6.7	6.6	.31	1.51
STONY CREEK	30.5	25.9	8.0	9.5	.34	1.32
SMITH BROOK	20.2	20.8	7.8	7.3	.38	1.31
LEBLANC CREEK	8.0	14.2	4.6	4.7	.36	1.42
BREAU CREEK	53.0	35.8	16.2	10.1	.52	1.39
ROCKWELL CREEK	8.7	12.7	4.0	4.1	.52	1.21
TURNER CREEK	2.7	7.0	1.9	2.4	.47	1.20
ROBBS BROOK	2.8	9.6	4.3	3.0	.31	1.62
BLACK BROOK	8.7	14.5	6.6	6.5	.21	.92
FOX BROOK	149.7	26.1	8.4	7.2	2.89	.60
PALMERS CREEK	43.7	31.3	9.5	8.9	.55	1.34
MEMRAMCOOK RIVER	398.6	98.1	49.0	29.5	.46	1.39

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.7)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BV

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
WILSON BROOK	12.2	17.5	7.4	6.4	.30	1.41
MCHENRY BROOK	5.6	13.2	4.0	5.0	.22	1.57
CURRYVILLE CREEK	5.2	11.8	3.7	4.6	.25	1.46
DEMOISELLE CREEK	51.6	38.2	12.4	11.1	.42	1.50
HAMILTON CREEK	7.9	12.5	5.5	3.8	.55	1.25
DANIELS BROOK	4.2	8.3	2.5	2.4	.73	1.14
TINGLEY BROOK	4.1	10.8	5.4	4.7	.19	1.50
LITTLE STREAM	12.5	17.1	5.4	5.5	.41	1.36
WEST RIVER	28.1	29.6	12.3	10.3	.26	1.58
NORTH RIVER	21.8	24.7	9.2	9.8	.23	1.49
TOMS BROOK	5.5	12.5	4.9	5.3	.20	1.50
BEAVER BROOK	10.3	15.1	5.4	5.4	.35	1.33
FAIRY CREEK	2.3	6.2	2.1	2.3	.43	1.15
CRANK BROOK	34.6	15.4	4.6	5.9	.99	.74
FLAG BROOK	6.7	10.9	4.5	4.4	.35	1.19
NW BRANCH CROOKED CH	8.1	11.3	3.9	4.3	.44	1.12
RAT TAIL BROOK	4.0	7.9	2.8	3.1	.42	1.11
WELLS BROOK	11.6	14.7	5.6	5.8	.34	1.22
RHODY BROOK	4.0	10.1	3.8	4.0	.25	1.42
BEAR BROOK	2.3	6.1	1.6	2.2	.48	1.13
MCKINLEY BROOK	4.2	9.0	3.1	3.3	.39	1.23
KEILLOR BROOK	6.5	11.3	3.5	3.8	.45	1.25
LUNSDEN BROOK	2.8	7.7	2.2	3.2	.27	1.30
PRESCOLT BROOK	19.6	18.4	5.5	6.1	.53	1.17
CALEDONIA BROOK	11.3	19.3	7.3	6.7	.25	1.62
GEORGES BROOK	10.2	16.3	1.8	2.5	1.6	1.44
CANADA CREEK	3.3	8.9	3.9	3.5	.27	1.38
ACADIAN VAULT BROOK	2.0	7.2	2.7	2.7	.27	1.44

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.7)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BV

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
CROOKED CREEK	127.3	50.5	21.1	14.1	.64	1.26
CHAPMAN CREEK	8.9	15.8	5.9	7.0	.18	1.49
MEMEL CREEK	13.5	17.4	6.3	6.5	.32	1.34
CHEMICAL CREEK	8.6	13.4	5.3	5.3	.31	1.29
SAWMILL CREEK	31.2	35.5	18.4	13.8	.16	1.79
COMSTOCK CREEK	8.8	16.0	5.4	6.4	.21	1.52
DALEY BROOK	2.2	6.3	1.5	2.2	.45	1.20
APPLE CREEK	3.5	9.0	5.2	3.9	.23	1.36
SHEPODY RIVER	159.3	55.7	27.5	19.0	.44	1.24
NEW HORTON CREEK	11.1	19.1	7.4	7.0	.23	1.62
TWO RIVERS CREEK	4.6	11.7	3.9	3.8	.32	1.54
BARN MARSH CREEK	4.0	12.7	5.5	5.5	.13	1.79
NEWFOUNDLAND CREEK	10.6	18.6	7.7	6.6	.24	1.61
HORN BROOK	3.0	11.6	5.6	5.5	.10	1.89
LONG MARSH CREEK	10.0	18.5	7.3	8.2	.15	1.65
ANDERSON HOLLOW BROOK	1.5	5.2	1.4	1.6	.59	1.20
ALCORN BROOK	5.2	12.0	2.4	2.9	.62	1.48
FLAT BROOK	1.6	6.8	2.5	2.8	.20	1.52
WILSON BROOK	4.0	11.9	4.2	4.3	.22	1.68
CLEVELAND BROOK	19.7	20.0	7.8	8.3	.29	1.27
KEIRSTEAD BROOK	16.0	14.9	4.9	5.1	.62	1.05
BARRETT BROOK	7.1	11.4	4.0	4.7	.32	1.21
SWAMP BROOK	5.1	9.5	3.8	3.7	.37	1.19
CAINS BROOK	5.1	9.7	3.5	3.3	.47	1.21
HALEY BROOK	16.6	20.0	5.2	5.8	.49	1.38
LAVERTY BROOK	13.8	19.2	8.8	6.8	.30	1.46
ASH BROOK	1.7	5.8	1.4	2.3	.32	1.25
BROAD RIVER	24.3	25.7	7.7	8.2	.36	1.47

***F.F. ≡ Form Factor**
#C.C. ≡ Compactness Coefficient
**** 1:250,000 scale**
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.7)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BV

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
DUFFY BROOK	5.3	11.6	3.8	3.3	.49	1.42
MCGEE BROOK	5.7	13.3	5.2	5.5	.18	1.57
CHERRY BROOK	3.7	9.2	3.1	3.3	.34	1.35
PINE BROOK	5.5	10.3	2.7	3.3	.51	1.24
LONG BEACH BROOK	5.1	10.7	3.5	4.0	.32	1.34
FORTY FIVE RIVER	58.8	37.7	14.7	14.9	.26	1.39
MACALONEY BROOK	1.2	6.0	2.1	2.7	.16	1.55
THIRD VAULT BROOK	10.2	13.1	5.2	4.6	.48	1.16
SECOND VAULT BROOK	8.6	15.8	5.8	6.2	.22	1.52
LAKE BROOK	10.5	17.7	5.9	6.8	.23	1.54
GREENOUGH BROOK	1.9	7.3	2.4	2.7	.26	1.49
KINNIE BROOK	8.0	14.5	4.8	5.8	.24	1.45
UPPER SALMON RIVER	190.7	57.6	21.5	20.7	.46	1.18
SPRING BROOK	2.2	7.5	1.7	2.9	.26	1.43
DICKISON BROOK	4.4	8.8	2.1	3.5	.36	1.18
TRACY LAKE BROOK	1.7	5.8	2.2	2.1	.39	1.25
CARIBOU LAKE BROOK	1.5	5.9	1.9	2.5	.24	1.36
BLACK BROOK	3.6	8.6	2.0	3.3	.33	1.28
BENNETT BROOK	28.9	25.6	10.4	10.9	.24	1.34
BRANDY BROOK	1.4	4.8	1.2	2.0	.35	1.14
MATTHEWS BROOK	4.2	10.4	2.5	3.9	.28	1.43
RAT TAIL BROOK	6.1	12.5	5.0	5.3	.22	1.42
BASKIN BROOK	0.8	4.1	1.0	1.5	.36	1.29
SWEENEY BROOK	2.3	7.9	2.6	3.3	.21	1.47
FOSTER BROOK	4.0	10.3	3.8	4.5	.20	1.45
HUESTON BROOK	4.9	10.9	3.9	3.8	.34	1.39
HASTIE BROOK	0.9	4.6	1.3	1.8	.28	1.37
SECOND MILE BROOK	3.0	8.4	2.4	3.1	.31	1.37

*F.F. ≡ Form Factor
#C.C. ≡ Compactness Coefficient
** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.

TABLE (F.7)

PHYSICAL DESCRIPTION OF SELECTED WATERCOURSES

DRAINAGE INDEX SUBDIVISION 1BV

Name of watercourse	Drainage Area (sq.Km)	Basin Perimeter (Km)	Meander Length (Km)	Basin Length (Km)	Basin Shape	
					F.F.*	C.C.#
FIRST MILE BROOK	1.5	5.7	1.3	1.9	.42	1.31
MILE BROOK	5.0	10.4	3.4	3.8	.35	1.31
SCHOOLHOUSE BROOK	0.8	4.3	0.7	1.8	.25	1.36

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** 1:250,000 scale
Coversion Factor: 1 mile = 1.609 Km.